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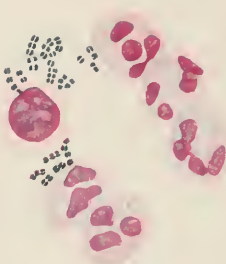


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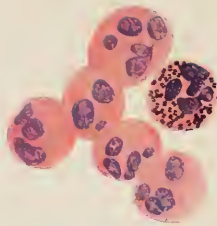




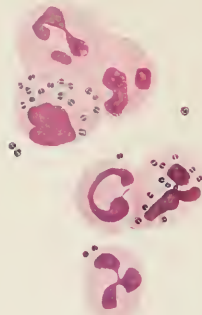
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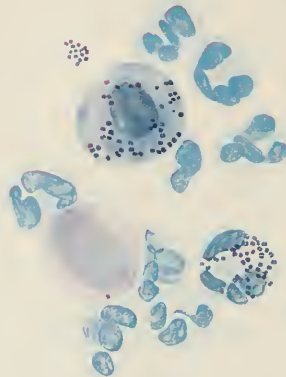
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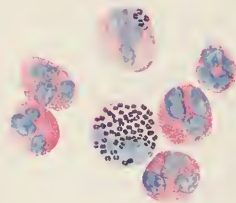
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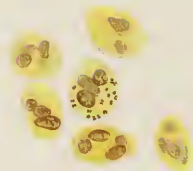
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GONOCOCCI IN PUS.

Gonococci stained by—1, Knaack's method. 2, Neisser's double stain. 3, Lanz's method. 4, Löffler's methylene-blue. 5, Romanowsky's stain (Leishman's modification). 6, Leszczynsky's method.

# GONORRHEA IN WOMEN

ITS PATHOLOGY, SYMPTOMATOLOGY, DIAGNOSIS, AND  
TREATMENT; TOGETHER WITH A REVIEW OF  
THE RARE VARIETIES OF THE DISEASE  
WHICH OCCUR IN MEN, WOMEN  
AND CHILDREN

BY

CHARLES C. NORRIS, M.D.

INSTRUCTOR IN GYNECOLOGY, UNIVERSITY OF PENNSYLVANIA; ASSISTANT GYNECOLOGIST  
TO THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA; PHYSICIAN TO  
THE MATERNITY HOSPITAL, PHILADELPHIA

WITH AN INTRODUCTION BY

JOHN G. CLARK, M.D.

PROFESSOR OF GYNECOLOGY, UNIVERSITY OF PENNSYLVANIA; GYNECOLOGIST-IN-CHIEF TO  
THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA

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John G. Clark





## INTRODUCTORY

IN this exceedingly comprehensive volume on gonorrhea Dr. Norris has placed before us, in a most interesting and instructive way, the many phases of this subject. The historic narrative, which leads back to the earliest records of the disease, is intensely entertaining, following as it does the curious and bizarre views expressed in ancient literature regarding the affection up to the description of the remarkable experiment performed by Hunter upon himself, in which he endeavored to show that the specific virus of gonorrhea and that of syphilis were interchangeable. As a result of this remarkable but fallacious experiment Hunter's theory of the mutual identity of the two infections was accepted by the profession without further question. In spite of the later and well-sustained dissent by Ricord, this view continued to hold sway, and was not entirely dissipated until the discovery, by Neisser, of the specific microorganism of gonorrhea. This discovery put an end to the long-agitated discussion, and for the first time a scientific foundation was established upon which all modern work along this line has been constructed.

One learns from the ancient documents, as set down by Dr. Norris, that the ravages of gonorrhea were recognized, and that strenuous efforts were made, by segregation and other restrictive means, to limit its spread.

In the chapter on Bacteriology and the Pathogenesis of Gonorrhea, the author has very clearly described the best cultural and staining methods, and traced the destructive effects of the gonococcus upon the pelvic organs and other tissues of the body. This study is elaborately illustrated from gross and microscopic sections made by Dr. Norris from the extensive collection in the pathologic laboratory of the Gynecologic Department of the University of Pennsylvania. The literature has been carefully compiled, and has been so well digested as to furnish an almost encyclopedic review of all the various aspects and history of the Neisserian infection.

In the chapter on Sociology the author has considered the relationship of gonorrhea to sterility and abortion, and has shown the havoc that is wrought in the destruction of the eye-sight of new-born infants as the result of maternal infection. Statistics have been carefully compiled demonstrating the serious effects of this disease upon the

given individual, and, more especially, its pernicious influence upon the general civic body.

The various methods adopted by the governments of Europe and the Orient for the limitation and suppression of the social evil have been reviewed, and the situation as it exists in the United States has been very thoroughly dealt with. Arguments for and against municipal supervision of prostitution are presented, and the author accepts the conclusion, reached by the majority of physicians and a large body of social workers, that legal restraint is of little actual value in the curtailment or abrogation of this evil.

Under the head of Prophylaxis the methods of preventing the spread of the disease are presented. Special stress is laid upon the necessity for educating patients as to the communicability of this malady, and for protecting innocent individuals against its serious immediate and remote effects. The author insists upon the necessity for an obligatory certificate of health for the male before marriage should be permitted. He condemns the policy of rigid secrecy relative to venereal diseases that now prevails, and lays particular stress upon the advantage to be gained by making these diseases notifiable. In other words, the author would have gonorrhea treated like all other diseases that, through their contagiousness, threaten the general public. Individuals so affected should, therefore, he maintains, be segregated in special hospitals or kept under rigid observation until a cure has been effected.

A full description of the approved methods of examination and of the means for ascertaining with certainty the presence of the gonococcus is given in a separate chapter. The necessity for ascertaining when a cure has been effected has been dwelt upon. The author deplores the light and careless manner in which gonorrhea has been treated in the past, and considers the profession partially responsible for the spread of this disease. He regards as criminal laxity the neglect of physicians to determine that an actual cure has been effected before an infected individual is permitted to marry.

In tracing the pathologic changes incident to this infection, a topographic sequence has been adopted, beginning first with the external genitalia and following the process through the generative tract to the ovaries and tubes.

A subsequent chapter is devoted to a comprehensive description of operative methods of treatment, and special attention is directed to the necessity for instituting conservative medical treatment before surgical intervention is undertaken. Thus the surgeon endeavors to subdue the inflammation, and later, if necessity arises, removes, by

surgical means, any pathologic residuum or débris that may remain after the gonococcal storm has passed, conserving those organs or portions of tissue that still have functional value, rather than sacrificing the pelvic generative organs in toto. This conservative policy should be applied particularly to young individuals, in whom this infection so frequently occurs.

A chapter has been devoted to the consideration of Diffuse Gonorrheal Peritonitis, a subject that is comparatively little understood by physicians and surgeons, because of its infrequent occurrence, the infection usually expending its virulence upon the adnexa and the pelvic peritoneum and rarely spreading to the upper abdomen.

An important chapter is that dealing with Gonorrhea During Pregnancy, Parturition, and the Puerperium. In maternity cases it is especially important for physicians and attendants to be ever on the alert, first, to prevent the spread of the disease in the mother, and, secondly, to give the most minute attention to the new-born child, to protect it against the life-long misery that may come from ophthalmia neonatorum.

The final chapter deals exhaustively with the medicinal treatment of gonorrhea. The various clinical methods for the detection of the infection and a comparative study of the results of treatment are given in comprehensive detail, with a final summary, by the author, of what he considers to be the proper therapeutic care of these patients. The relative value and the present status of the serum and vaccine treatments are considered in this chapter. An extensive bibliography, from which the author has selected a vast amount of splendid material, citing innumerable articles to which one may turn to consult these original sources, completes the book.

The careful student will find, after a close perusal of the work, that the author has written a highly instructive treatise, in which he has most satisfactorily encompassed the many aspects of this complicated question. He has reviewed in detail the several divergent sociologic views concerning this colossal evil, and, as a commentary, offers judicious suggestions that will be of value to those who are endeavoring to find the best solution for these problems. Because of the broad and comprehensive character of the book, it will be of great value to the physician, the surgeon, the specialist, the legislator, and the sociologist.

JOHN G. CLARK.



## PREFACE

UNTIL a comparatively recent date gonorrhea has been regarded by many medical men as a purely local disease, and it is only during the last twelve or fifteen years that the rare lesions resulting from this infection have been traced to their proper source. Indeed, prior to the appearance of Noeggerath's epoch-making monograph even the common intraperitoneal manifestations of gonorrhea were not recognized. Up to this time practically all pelvic inflammations were regarded as cellulitis, and their etiologic relationship to gonorrhea was not generally known, although Goupil and Bernutz had described the pathology as early as 1862. The discovery of the gonococcus by Neisser in 1879 placed the study of gonorrhea upon a scientific basis, and within recent years the symptomatology and pathology that follow in the wake of this infection have received marked attention.

In the preparation of a work such as this one of the chief difficulties consists in selecting the important and omitting the unimportant references to the various subjects dealt with. This difficulty will be apparent when it is considered that during the last ten years over 20,000 papers bearing more or less directly upon the subject of gonorrhea have appeared. From this voluminous material over 2300 references have been utilized, and even in this moderately extensive list it is likely that some important publications have been overlooked. The chapter on Serum and Vaccine Therapy and Organotherapy is based largely on the work of other investigators. For the indications and technic of this form of treatment the reader is referred to the special chapter devoted to this subject. Chapters XI and XII, the substance of which appeared in *Surgery, Gynecology, and Obstetrics*, October, 1910, and which was written in collaboration with Dr. John G. Clark, have been extensively revised and brought up to date.

In the selection of the literature an endeavor has been made to utilize only such material as embodies the most modern trend of science or that refers to rare cases. The attempt has been made to incorporate either references to or abstracts from the reported histories of all unusual gonorrheal lesions. Thus, under this head will be found a short abstract of all cases of rupture or torsion of the uterine adnexa in inflammatory conditions, of all gonorrheal lesions of the pleura and

kidney, etc. The not infrequent practice of reporting rare cases under misleading or ambiguous titles is especially to be deprecated, and makes the complete list of such cases practically impossible to obtain.

I wish to acknowledge my indebtedness to the excellent papers of Finger and Spooner, which have been extensively drawn upon in compiling the chapter on the History of Gonorrhea. Stephenson's masterly monograph on ophthalmia neonatorum has been freely utilized in the chapter on eye lesions. Nixon's important article on renal gonorrhea, and Menge's monograph on gonorrhea in women, have also been found of great assistance, as well as many other valuable contributions too numerous to mention, the references to which can be found in the foot-notes.

In the preparation of this work I have received the most hearty support and encouragement from Dr. John G. Clark, who has placed at my disposal his abundant clinical and pathologic material. It gives me much pleasure to acknowledge my indebtedness to Dr. Thomas B. Holloway, who has kindly reviewed the chapter dealing with eye lesions and has made many valuable suggestions. My thanks are also due to Dr. George W. Outerbridge for reading the chapter on the Pathology of the Female Genital Tract, to Miss Dorothy Peters, for the excellent illustrations, and to the W. B. Saunders Company, for much practical aid and for painstaking efforts to obtain the best possible reproductions of the drawings.

CHARLES C. NORRIS.

1503 LOCUST STREET, PHILADELPHIA, PA., *May*, 1913.

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# GONORRHEA IN WOMEN

## CHAPTER I

### HISTORIC

THE term gonorrhea originated with Galen,<sup>1</sup> who described the condition about A. D. 160. He believed gonorrhea to be an involuntary escape of semen. The word itself is derived from the Greek γονή, seed; and ρεῖν, flow. *Blennorrhea* is a flow of mucus; *blennorrhagia*, an outpouring of mucus; whereas *pyorrhea* indicates a purulent discharge. It will be seen that, therefore, etymologically, the term "gonorrhea" is inaccurate. The name has, however, been so generally adopted, and is in such common usage, that any change of title of this disease would be ill advised and lead only to confusion. "Clap," a term so often applied to gonorrhea, especially in men, is, according to Sevediaur, derived from "clapiers," which were public shops kept by prostitutes. Laeroix,<sup>2</sup> however, tells us that in Paris, during the Middle Ages, the prostitutes were domiciled in a quarter ultimately designated Clapier, and that it is from this locality that the word derives its origin. The terms—clap and gonorrhea—are used interchangeably by many writers. Among the synonyms of gonorrhea known to the laity are such terms as drop, nipper, a dose, and other more vulgar names. Although there are no means at our command of positively identifying gonorrhea in the early ages, it is almost certain that the disease can be traced back to the earliest records of the human race, its progress through the generations having left in its wake a blind, halt, maimed, sterile, and sexless multitude. Prokseh<sup>3</sup> reports that an old Japanese manuscript, written in B. C. 900, contains an accurate description of gonorrhea. The disease was probably prevalent among the early Egyptians.<sup>4</sup>

Herodotus (B. C. 484) relates how, after the Scythians, during an expedition to Ascalon, a city of Syria, had despoiled the temple of

<sup>1</sup> Galen: De Loc. Affec., 2, 8, Edit. Ruhn, 3, p. 91.

<sup>2</sup> Prostitution au Moyen Age, Fol. ii; cf. Du Cange, Glossar., sub. v, Clapier.

<sup>3</sup> Prokseh, J. K.: Die Geschichte d. ven. Krankh., Bonn, P. Hanstein, 1895, vol. i, p. 97.

<sup>4</sup> Veit: Handb. d. Gynäkologie, vol. ii.

Venus Urana, they were attacked by a disease called "*thenousos thelia*." This was in all probability gonorrhea. Hippocrates mentions *dysuria*, and speaks of a whitish leukorrhea. Ureteral and preputial ulcers are described by Celsus (A. D. 164), who also refers to a purulent or bloody discharge issuing from the canal and orchitis, but does not mention that this was due to or followed sexual congress. His treatment consisted of cold baths, massage, with the local application of rue and vinegar, and food and drinks of a cooling nature. Galen (A. D. 130) believed that gonorrhea was due to the semen having acquired a poisonous quality. A similar view was held by Pliny (A. D. 115). Marcellus Empiricus, physician to the Emperor Theodosius, gives his treatment for what was probably gonorrhea. Ali Abbas writes of the symptoms of urethritis, and recommends various refrigerant and sedative remedies, such as coriander, lentils, fleawort, poppies, roses, henbane, and lettuce, together with emetics and blood-letting, if the patient be of a plethoric habit. He also advises sleeping in a cool bed and the wearing of a metal plate over the loins. Dioscorides<sup>1</sup> recommends the internal use of hemlock. Maimonides describes urethritis as follows: "The fluid escapes without erection and without a feeling of pleasure; the appearance of the discharge is similar to that of barley dough dissolved in water or coagulated albumin, and is the result of an internal disease; it is essentially different from the seminal fluid and mucus, the latter being more homogeneous." The same writer mentions a number of causes for the disease, including amorousness and excesses of various kinds. Other references to venereal diseases, probably gonococcal in origin, may be found in the works of Juvenal, Martial, Sextus Placidus, Scribonius, and Aretæus. Although we have no indisputable record that gonorrhea existed among the Romans, it seems practically certain that this was the case. Rome was the richest city in the world—a city whose inhabitants numbered four millions (Lipsius); an era of peace, luxury, and vice hitherto unknown in the world's history had settled over the community. Prostitution was rife. Even Agrippina would leave the palace of the Cæsars to spend the night in the brothels of the city. Caligula had a brothel in his palace.<sup>2</sup> Nero was a habitual frequenter of houses of prostitution, and dined in public at the great circus with hordes of prostitutes. The public baths, which were used by men and women, boys and girls, all in a state of complete nudity, were little more than houses of assignation.<sup>3</sup> According to Herodotus, the women threw aside their modesty with their clothes. The *aliptes*, or sham-

<sup>1</sup> Dioscorides: Meth. med., vol. iv, p. 79.

<sup>2</sup> Juvenal: Sat., vi.

Pliny: Nat. hist., 33, 54.

poors, who massaged the bathers, were members of the lowest class. The most virtuous private citizens decorated the walls of their houses with lewd sculptures and lascivious frescoes.<sup>1</sup> The character of the Roman banquets is too well known to need description.<sup>2</sup> Statues of Venus and of the god Priapus were exhibited freely to the public gaze. Offerings were made to these deities in the form of small cakes representing the female and male organs of generation, and were sold in all the bakeries. The monstrous indecency of the statues of Priapus was their chief feature—an image that

“Maids peer at through fingers held before the face.”<sup>3</sup>

The law regarded all servants waiting upon travelers at inns or taverns as prostitutes. Among all classes immorality reigned supreme. Well might Juvenal cry, “Vice has culminated!”<sup>4</sup> Amid such depraved conditions venereal disease must surely have thrived apace. In spite of this, these diseases occupy but a small space in the medical literature of this period. This is due to two facts: first, the Roman physicians did not generally allude to these diseases, believing that they were beneath their dignity. Thus Celsus, before referring to the subject, apologizes for mentioning the disease—“Quæ invitissimus quique alteri ostendit”;<sup>5</sup> and, secondly, the Roman physicians refused to treat venereal diseases, which we find referred to under the general term “*morbus indecens*.” As a consequence, the rich were treated by their slave doctors, whereas the poor were probably attended by the *archiatri*, who occupied somewhat the same position as does the district physician of the present day, and who were bound to treat all diseases among the poor gratuitously, although they might demand a fee from the wealthy.<sup>6</sup>

For diseases of the groin the Romans used a plant called “*bubonium*,” from which the term “*bubo*” doubtless took its origin. To the Greeks this remedy was known as *bombornion*. Roman women affected with secret diseases were called *aucunnuenta*, a term that explains itself. The Romans said of a female who communicated a disease to a man, “*Haec te imbubinat*” (Scalinger). Sanger<sup>7</sup> states that no passage in the ancient writers directly ascribes venereal diseases to commerce with prostitutes, but adds, however, that no medical

<sup>1</sup> Propertius: ii, 6; Suet.: Tib. and Vit. Hor.; Pliny: xxxv, 37; see also the collections at the Museo Borbonico at Naples, etc.

<sup>2</sup> Petron: Satyr, vol. ii, pp. 68, 70.

<sup>3</sup> Martial: vol. iii, p. 60.

<sup>4</sup> Juvenal: Sat. vi.

<sup>5</sup> Dig. 27, i, 6; Cod. Theodos., xiii, 3.

<sup>6</sup> De Medic. et profess.

<sup>7</sup> Sanger, W. W.: The History of Prostitution, The Medical Publishing Co., New York, 1906, p. 85.

reader of the history of Rome under the Empire can doubt but the archiatri filled no sinecure, and that a large proportion of the diseases they treated were directly traceable to prostitution.

The morality of the Greeks was no better than that of the Romans, and it is probable that venereal diseases were by no means unknown. Indeed, Dufour<sup>1</sup> states that it was the fear of venereal diseases that was responsible for many of the sexual perversions of the ancient Greeks.

That the ancient Jews were acquainted with gonorrhea and were aware of its contagiousness there can be little doubt. In the fifteenth chapter of Leviticus, Moses, about B. C. 1471, not only warned the children of Israel of the dangers of gonorrhea, but laid down definite sanitary and police regulations for its prophylaxis, many of which might be adopted with advantage at the present day. In Deuteronomy, chapter xxiv, verse 1, it is stated that if a man marry a woman "and it come to pass that she find no favour in his eyes; because he hath found some uncleanness in her; then let him write her a bill of divorcement." The historian Josephus relates how the Jews, on their way to Canaan, contracted venereal diseases. In the Jerusalem Talmud numerous references are made to gonorrhea, and in the Babylonian Talmud venereal diseases are frequently mentioned. After a careful study of both Talmuds there can be little doubt in the reader's mind that gonorrhea played an important rôle in the etiology of the diseases of women in ancient times. In Numbers v : ii we find the Israelites instructed to "put out of the camp every leper, and every one that hath an issue." It should be stated that some difference of opinion has existed in regard to the interpretation of the word "issue." Some authorities believe that this does not refer to a venereal disease, and base their argument on the thirteenth verse of the fifteenth chapter of Leviticus, which says: "When he that hath an issue is cleansed of his issue; then he shall number to himself seven days for his cleansing." It is urged that if the word "issue" referred to a venereal disease, the patient could hardly expect to be cured in eight days. This interpretation, however, appears incorrect, for if we consider the twenty-eighth verse of the same book and chapter, which deals with menstruation, we find, "But if she be cleansed of her issue, then she shall number to herself seven days and after that she shall be clean." From this it would appear that the proper interpretation of verse 13 should be that "when he hath an issue and is cleansed of his issue (after being quite cured), he shall then number to himself seven days for his cleansing."

<sup>1</sup> Dufour: History of Prostitution.



In the writings of the Middle Ages many references to gonorrhea occur. Among works of the early Arabian writers there are numerous and accurate descriptions of the symptoms and methods of treatment. Accurate dates of the various writings of this period are obtained with difficulty, but Johannes Mesue writes in the tenth or eleventh century as follows: "Si vero in via et duetus urinæ ulcera sunt, cognoscuntur ex dolore majis in urinæ egrissione et sanie egrediente ante urinam. Ulcera virgæ et apostemata sunt proportionalia ulceribus et apostemalibus testium."<sup>1</sup> Ebu Sina describes urethritis thus: "Sentitur acuitus et mordicatio in egressione et quandoque est cum eo ardor urinæ, et est color ejus ad citrinitatem declinis."<sup>2</sup> Serapion gives a clear description of the suppurations of the external genitalia of women, which he believed were due to sexual excesses. He also writes at length of urethritis in the male, and recommends the use of hemp in its treatment. Rhanges describes a disease that caused burning during micturition. In the eleventh century Albucasis<sup>3</sup> treated urethritis by injections of vinegar and water. It is interesting to note that most of the earlier writers gave but little attention to gonorrhea in the female, the intraperitoneal complications of which were not recognized. Michael Scotus,<sup>4</sup> physician to Emperor Frederick I, in the early part of the thirteenth century, recognized the infectious character of gonorrhea. Gariopontus also discusses the disease. Lenfrancus, a distinguished physician of the thirteenth century, who received his early surgical training in Paris in 1295-1306, and who was a pupil of William de Saliceto, describes the induration of the testicles. He also recognized the infectious nature of gonorrhea, and as a prophylactic recommended washing the penis in vinegar and water after coitus. Guido de Cauliaco, in his "Surgery," mentions urethritis as a condition following intercourse with a diseased woman. Constantinus Africanus recommends remedies for strangury. Johannes de Gaddesden wrote of vaginitis, urethritis, and epididymitis. Johannes Arden, physician to Richard II and Henry IV, believed urethritis to be due to excoriation of the urethra, and recommends as treatment injections of human milk, to which were added almond milk, sugar, and violet oil. Antonio Cermisone, a professor in Pavia and in Padua, and who died in the latter place in 1441, recognized gonorrhea as an infectious disease and

<sup>1</sup> "The presence of ulcers on the urethra may be recognized by the occurrence of severe pain on urination and the discharge of purulent secretion and shreds of tissue. The ulcers correspond with those on the penis and on the testes."—(Trans.)

<sup>2</sup> "Sharp pain and itching are experienced during urination, and burning and smarting are present along the entire urethral canal. The urine is of a light lemon-yellow color."—(Trans.)

<sup>3</sup> Albucasis: Lib. theoret. nec. non pract. Alsaar. Angus Windel. 1519, fol., p. 92a.

<sup>4</sup> Scotus: De Procr. et hom. Physion., op. S. I, 1477, Cap. 6-10.

treated it by means of astringents. Further references to gonorrhea may be found in the works of Joannes Arculanus, Valescus de Taranta, Magnusus, Gulielmus Vareguana, Antonio Cermisone, Johannes de Tornamira, and many others. Beckett tells us of an ordinance formulated by the Bishop of Winchester for the purpose of checking the spread of gonorrhea. One of the articles, "*De his qui custodiant mulieres habentes nefandam infirmitatem*," reads as follows: "That no Stewholder keep noo woman wythin his hous, that hath any sycknesse of Brenning" (the perilous infirmity of burning). This ordinance is said to date back to the year 1162. Another ordinance of this Bishop is to the effect that no woman affected with "the perilous infirmity of burning" shall be harbored in any of the eighteen houses of prostitution that were situated in Southwark, and were said to have been under his jurisdiction. A somewhat similar ordinance was found, dated August 8, 1343, and attributed to Joanna I, Queen of both Sicilies, the fourth article of which was as follows: "The Queen commands that the Superintendent and a surgeon, appointed by the authorities, examine, every Saturday, all the whores in the houses of prostitution. And if one is found who has contracted a disease from coitus, she shall be separated from the rest and live apart, in order that she may not distribute her favors and may thus be prevented from conveying disease to the young men." The fear of venereal diseases in the early ages was very great. Sanger<sup>1</sup> informs us that afflicted individuals were driven into the fields to die, the physicians refusing to attend the sick for fear of becoming infected. He also adds that many writers doubted this form of contagious influence, and held that it required intercourse, or at least contact. But nobles, and especially the clergy, preferred to ascribe their maladies to misfortune rather than to licentiousness, and sought to "put down" such innovations. The consequence of this view was that any but wealthy venereal patients had extreme difficulty in obtaining treatment, and as a result many severe cases were found. This lack of treatment doubtless partially accounts for the supposed malignancy of venereal diseases of this period.

Toward the end of the fourteenth century it would seem that the infectious nature of gonorrhea and the mode of its contagiousness were pretty definitely recognized. Numerous ordinances and police regulations for its control were in force, and medical supervision of houses of prostitution was inaugurated. At this time it would appear that a fairly definite distinction was made between syphilis and gonorrhea. Owing to the prevalence of venereal disease James IV, in 1497, issued his celebrated proclamation, banishing all the infected

<sup>1</sup> Sanger: The History of Prostitution, 1906.

from the city of Edinburgh. This proclamation, however, was probably aimed at syphilis more than at gonorrhea. In London, in 1430, during the reign of Henry VI, a police regulation was in force excluding all venereal patients from public hospitals, and requiring them to be strictly guarded at night. Just how this guarding was to be carried out is not stated. In the reign of Henry VIII there were six lazaret-houses in London for the reception of venereal patients. All were located some distance from the city proper. Toward the end of the fifteenth century Europe was swept by an epidemic of syphilis. So severe and devastating was this, and of so malignant a character was the disease, that gonorrhea sank into comparative insignificance. Up to this time a definite distinction had been made by most authors between the two diseases.

The sixteenth century, as regards venereal diseases, is generally looked upon as one of confusion. At this time syphilis, which was so widespread, was a comparatively new disease, and was but little understood by many physicians. It has previously been pointed out that the early writers paid but scanty attention to the occurrence of gonorrhea in the female, and with our present knowledge of the latency of this disease in the external genitalia of women, and the difficulty of diagnosis even with our present-day methods, the attitude of the earlier physicians can readily be understood. Endometritis and endocervicitis were regarded as uterine catarrh, and their etiologic association with gonorrhea was unknown. The intraperitoneal complications of gonorrhea were not recognized. What wonder, then, that James Cuta-neus, in 1504, stated positively that gonorrhea could be contracted from a healthy woman—an opinion shared by many eminent authorities at a much later date. Paracelsus,<sup>1</sup> as early as 1530, regarded gonorrhea as a complication of syphilis. This opinion was shared by Musa Brassavolus (1553), and later by his pupil, Gabriello Fallopius. In this view these physicians were almost alone.

However, from the appearance of the first epidemic of syphilis early in the fifteenth century, a general change seems to have taken place. Joannes de Vigol (1513), in his "Surgery," in Chapter de Auxiliis Ægritudinum Virgæ, writes in detail of gonorrhea and its treatment. Marcellus Cumanus (1495), a military surgeon of the Venetian army during the period of the first epidemic of syphilis, and a physician of extensive experience in venereal diseases, and Alexander Benedictus (1510), both discussed syphilis and gonorrhea separately.

<sup>1</sup> Paracelsus: Von d. französ. Krankh., Nuremberg, 1529.

In 1527 Jacques de Rethencourt, of Rouen, wrote an interesting history of gonorrhea, and was the first to use the term venereal in conjunction with diseases pertaining to sexual intercourse. In England, Simon Fish (1530), Andrew Boord (1546), Michael Wood, and William Bulleyn (1560) describe gonorrhea, particularly in women, as a disease distinct from syphilis. During the sixteenth century gonorrhea seems to have been very prevalent in England, especially among the prostitutes. The disease was considered but a symptom of syphilis, and was so treated by such prominent writers as Petronius<sup>1</sup> (1565), Martiniere<sup>2</sup> (1644), Sydenham<sup>3</sup> (1680), Devaux (1711), Turner<sup>4</sup> (1717), and many others. As a result of this mistaken view, gonorrhea was treated vigorously with mercury, guaiac, and sarsaparilla. In a treatise published in 1563 we read: "The final symptom of syphilis is Gallic gonorrhea—thirty years may elapse before the discharge begins." However, more rational views regarding the etiology of syphilis and gonorrhea were held by some of the more acute diagnosticians. P. Haschard (1554) wrote, warning against the prevalent treatment of gonorrhea by large doses of mercury, stating that, in his opinion, the diseases were distinct and separate.

According to Stephenson,<sup>5</sup> the recognition of the connection between leukorrhea in the mother and ophthalmia in the infant dates to the year 1750, when G. S. T. Quellmalz<sup>6</sup> insisted upon the point. The fact was also mentioned by J. G. Goetz<sup>7</sup> in 1791, by C. G. Selle in 1793, and by A. Schmidt<sup>8</sup> in 1806. Gibson<sup>9</sup> also deserves credit for noting the clinical relationship between leukorrhea and ophthalmia. Morrison<sup>10</sup> (1808) and Saunders<sup>11</sup> (1811) also wrote confirming these views. But it remained for Vetch,<sup>12</sup> in 1820, to prove by experimental inoculation the truth of Gibson's assertion. Further references of historic interest regarding ophthalmia may be found in the works of Simmons<sup>13</sup>

<sup>1</sup> Petronius: *De Morb. Gallic. lib.*, September, 1565.

<sup>2</sup> Martiniere: *Traité de la mal. veneriennes*, 1664.

<sup>3</sup> Sydenham: *Epist. d. lui. vener. Hist. et curat.*, London, 1680.

<sup>4</sup> Turner: *Syphilis, etc.*, London, 1717.

<sup>5</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 22.

<sup>6</sup> Quellmalz, G. S. T.: *Cent. f. prak. Augenheilkunde*, February, 1894.

<sup>7</sup> Goetz, J. G.: *De Ophthalmia Infantum recens natorum*.

<sup>8</sup> Schmidt, A.: *Ophthalmologische Bibliothek* (K. Himly u. J. A. Schmidt), 1806, vol. iii, No. 2, p. 107.

<sup>9</sup> Gibson, B.: *Edinburgh Med. and Surg. Jour.*, 1807, p. 160.

<sup>10</sup> Morrison: *Med. and Physical Jour.*, 1808, vol. xx, p. 57.

<sup>11</sup> Saunders, J. C.: *A Treatise on Some Practical Points Relating to the Disease of the Eyes*, London, 1811.

<sup>12</sup> Vetch: *Practical Treatise on the Diseases of the Eye*, 1820, p. 242.

<sup>13</sup> Simmons, W.: *Edinburgh Med. and Surg. Jour.*, 1809, vol. v, p. 283.

(1809), Ware<sup>1</sup> (1814), Hagemisch,<sup>2</sup> Ryall<sup>3</sup> (1824), Green<sup>4</sup> (1824), Watson<sup>5</sup> (1828), Wishart<sup>6</sup> (1829), Jacob<sup>7</sup> (1834), Carmichael<sup>8</sup> (1839), Edwards<sup>9</sup> (1840), Lawrence<sup>10</sup> (1844), Whitehead<sup>11</sup> (1847), Watson<sup>12</sup> (1848), Oke<sup>13</sup> (1852), Tyler-Smith<sup>14</sup> (1853), Crédé<sup>15</sup> (1853), Mackenzie<sup>16</sup> (1854), Guyomor<sup>17</sup> (1858), Walton<sup>18</sup> (1865), Wells<sup>19</sup> (1865), Wilson<sup>20</sup> (1866), Noeggerath<sup>21</sup> (1872), Hulke<sup>22</sup> (1873), Ballard<sup>23</sup> (1859), Hogg<sup>24</sup> (1875), Neisser<sup>25</sup> (1879), and others that have been collected by Stephenson<sup>26</sup> in his excellent monograph.

Until 1753 the prevailing opinion was that a urethritis was due to the presence of an ulcer within the urethra. At about the beginning of the eighteenth century the opposition to the incorrect views held regarding the etiology of gonorrhea and syphilis began to become more insistent. Nevertheless, it was not until the end of the eighteenth century that the separate identity of these two diseases was generally accepted. At this time Finger and others write of the existence of two schools of syphilologists—the identists, who believed in the identity of the virus of gonorrhea and of syphilis, and the dualists, who held the contrary view. Hales<sup>27</sup> (1770) advocated the complete separation

<sup>1</sup> Ware, J.: Remarks on Ophthalmy, 1814, p. 126.

<sup>2</sup> Hagemisch: Horn's Arch. f. prak. Med., vol. iii, p. 208.

<sup>3</sup> Ryall, J.: Trans. Assoc. of the Fellows and Licentiate of the King and Queens College of Physicians in Ireland, 1824, vol. iv, p. 340.

<sup>4</sup> Green: Lancet, February 15, 1824, p. 213.

<sup>5</sup> Watson, A.: A Compendium of the Diseases of the Human Eye, second edition, p. 34.

<sup>6</sup> Wishart, J. H.: Edinburgh Med. and Surg. Jour., 1829, vol. xxxii, p. 253.

<sup>7</sup> Jacob, A.: "Ophthalmia," in Cyclopædia of Practical Med. by Forbes, Tweedie and Conolly, vol. iii, p. 198.

<sup>8</sup> Carmichael, H.: Dublin Jour. Med. Sci., 1839, vol. xv, p. 200.

<sup>9</sup> Edwards, C.: Lancet, July 4, 1840.

<sup>10</sup> Lawrence, W.: A Treatise on the Diseases of the Eye, 1844, p. 22.

<sup>11</sup> Whitehead, J.: Provincial Med. and Surg. Jour., 1847, p. 536.

<sup>12</sup> Watson, T.: Lectures on the Principles and Practice of Physic, 1848, vol. i, p. 309.

<sup>13</sup> Oke, W. S.: Provincial Med. and Surg. Jour., 1852, p. 29.

<sup>14</sup> Tyler-Smith, W.: Lancet, August 20, 1853, p. 157.

<sup>15</sup> Crédé: Klinische Vorträge über Geburts., 1853, vol. i, p. 160.

<sup>16</sup> Mackenzie, W.: Practical Treatise on the Diseases of the Eye, fourth edition, 1854.

<sup>17</sup> Guyomor, D.: Thèse de Paris, 1858, p. 45.

<sup>18</sup> Walton, H.: Med. Times and Gazette, 1865, vol. i, p. 559.

<sup>19</sup> Wells, J. S.: Lancet, August 21, 1865.

<sup>20</sup> Wilson: Dublin Quarterly Jour. Med. Sci., 1866, vol. xlii, p. 184.

<sup>21</sup> Noeggerath, E.: Die latente Gonorrhoe im weiblichen Geschlecht; also Trans. Amer. Gyn. Soc., 1876, vol. i, p. 268 et seq.

<sup>22</sup> Hulke: Med. Times and Gazette, 1873, vol. ii, p. 629.

<sup>23</sup> Ballard, J.: Brit. Med. Jour., 1859, p. 411.

<sup>24</sup> Hogg, J.: Med. Press and Circ., March 31, 1875.

<sup>25</sup> Neisser, A.: Cent. f. med. Wissens., July 12, 1879.

<sup>26</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907.

<sup>27</sup> Hales: Salivation not Necessary for the Cure of Venereal Diseases, etc., London, 1764; also letter addressed to Caesar Hawkins, etc., London, 1770.

of gonorrhea and the chancre virus. Ellis, in 1771, conducted a series of experiments that strengthened the belief that these were two distinct diseases. Bayford, in 1773, wrote opposing Ellis's views, basing his conclusions on the fact that he was unable to detect with the microscope any difference between gonorrheal and syphilitic pus. Tode (1774) combated the identity of gonorrhea and syphilis. Duncan (1777) advanced the argument that the inhabitants of Otaheite were familiar with syphilis long before gonorrhea was introduced among them. Mr. Wilson, surgeon to H.M.S. Porpoise, visited Otaheite in 1801, and after a careful investigation came to the conclusion that gonorrhea was then unknown on that island. Harrison (1781) and Swediaur (1784) employed the experimental method, but their results led them to support the view that syphilis and gonorrhea were identical.

Sir John Hunter<sup>1</sup> became deeply interested in this controversy, and on a Friday morning in May, 1767, performed the famous experiment that was destined to retard the medical progress of his day for many years. Hunter offered himself as a sacrifice for the cause under dispute. He made two punctures in his penis with a lancet dipped in venereal matter taken from a supposed case of gonorrhea—one puncture was made in the glans and the other in the prepuce. As a result, he developed syphilis. The inguinal glands became enlarged, a mucous patch appeared on one tonsil, and a copper-colored rash developed. As a consequence of this experiment Hunter came to the conclusion that syphilis developed from gonorrhea. The suggestion is made by Palmer<sup>2</sup> that Hunter, during one of the repeated dressings of the wounds on the penis, may have inoculated the sores with syphilitic virus. The other—and the more likely—explanation seems to be that a urethral chancre was in the first place mistaken for a gonorrhea. In view of Hunter's upright character and well-known veracity no other explanation is tenable. There can be no doubt that Hunter, although a keen observer, was impulsive, and likely to form hasty conclusions. Hunter<sup>3</sup> was considered at this period the first surgeon, the first physician, and perhaps the first scientist in all Europe. So well known was he, and so large a following had he, that this "personal experiment" could not fail to carry great weight, even with those who believed in the separate identity of gonorrhea and syphilis. It is true that Hunter distinguished between a "venereal" and a "simple" gonorrhea, and believed that the latter could develop from causes other than coitus, or even spontaneously, but he did not describe his

<sup>1</sup> Hunter: Works, edited by John Palmer, New York, 1841, vol. ii.

<sup>2</sup> Hunter: *Loc. cit.*

<sup>3</sup> Hunter: *Loc. cit.*



differential diagnosis clearly. He considered gleet non-infectious. It seems a cruel irony of fate that Hunter, after sacrificing himself for the cause of science, should have been forced into the position of the leader of a movement that has since been proved to have been a retrogression involving some sixty years.

Even so late as 1829 mercury was used in the treatment of gonorrhea in some of the large London hospitals, notwithstanding the fact that the Edinburgh school, through such men as Hales (1770), Howard<sup>1</sup> (1787), and Bell<sup>2</sup> (1793), taught that gonorrhea and syphilis were different diseases. Hogan's (1787) opposition to Hunter's doctrines went unnoticed. In 1793 Benjamin Bell<sup>3</sup> conducted a series of experiments that attracted considerable attention. Among other evidence that he adduced pointing to the separate identity of gonorrhea and syphilis was an experiment made upon two physicians, in whom gonorrheal pus was inoculated into the urethra, and neither of whom developed syphilis. Clossius (1797) coincided with Bell's conclusion. Evans and Le Bon (1789), by their experiments, strengthened Bell's position. Hernandez (1811) inoculated seventeen convicts with gonorrheal pus and all developed gonorrhea. Not one contracted syphilis as a result of the test. This was undoubtedly a most important experiment, and carried great weight with the medical profession in general. A new dispute now arose. Caron (1811), Desruelles (1826), and Devergie (1836) taught that gonorrhea was devoid of any specific virus, and that it was not a contagious disease. The careful and exact Germans had by this time come to the conclusion that gonorrhea was an entirely different disease from syphilis. They, however, denied its local character and regarded it as a general infection. In the works of Autheuriet (1809), Ritter (1819), and Eisenmann (1830) we find descriptions of various sequelæ or metastases of urethritis, such as gonorrhea of the lung, ear, and meninges, gonorrheal ulcer, neuroses, amaurosis, and congenital and acquired gonorrheal diatheses. Thus matters remained in this unsettled state until Phillippe Ricord<sup>4</sup> (1831-1837), with his large experience, brilliant critical and dialectic powers, impressed his teachings forcibly on the medical profession. This investigator made 667 inoculations of gonorrheal pus and in not a single case did syphilis result. In later experiments the same writer showed

<sup>1</sup> Howard: *Practical Observations on the Natural History and Cure of the Venereal Diseases*, London, 1787.

<sup>2</sup> Bell: *A Treatise on Gonorrhea*, Edinburgh, 1793; *ibid.*: *Treatise on Gen. Virul. and Lues*, London, 1793.

<sup>3</sup> Bell: *Loc. cit.*

<sup>4</sup> Ricord: *Lectures on Venereal and Other Diseases Arising from Sexual Intercourse*, Philadelphia, 1849.

that a urethral sore could furnish pus from which syphilis might develop. These experiments practically established the non-identity of gonorrhea and syphilis. No one can fail, on reading Ricord's works, to be impressed with his ability and with the bull-dog tenacity of purpose with which he brings his conclusions to the foreground.

Attention has previously been drawn to the fact that the early writers paid but little regard to gonorrhea in the female, and it was not until Noeggerath's<sup>1</sup> epoch-making observations were published in 1872 that the full significance of gonorrhea in women was realized. It is true that in 1857 Bernutz and Goupil<sup>2</sup> reported their observations of gonorrheal infections of the appendages and pelvic peritoneum, and that in 1858 West published a paper in which he ventured an opinion that in some cases gonorrhea might extend to the intraperitoneal generative organs. This view was subsequently supported by Dobson, Nelson, and Giles, but received little support from the profession in general. This was doubtless due to the fact that in the male a gonorrheal urethritis is an active and usually painful condition, and that a very large proportion of urethral discharges occurring in men are of gonorrheal origin, whereas in women urethritis or cervicitis was of itself of little moment, and rarely produced severe subjective symptoms, and that leukorrhea may be the result of a variety of causes.

As has been pointed out in previous pages, Ricord's numerous experiments and acute reasoning, together with the brilliant and pertinacious manner in which his conclusions were presented before the medical world, definitely established the separate identity of gonorrhea and syphilis, notwithstanding the fact that a few stubborn identists, such as Eisenmann, Vidal de Cassis, Simon, and Caron, were still occasionally heard from.

For many years prior to the victory of the unitists, headed by Ricord, two forms of urethritis had been recognized by Hunter,<sup>3</sup> Brassa-volus, and others. These two varieties were spoken of as gonorrhœa virulenta and gonorrhœa simplex. Now that the gonorrhœa virulenta, or syphilis, was satisfactorily accounted for, the question arose, was the gonorrhœa simplex, or, to avoid confusion, was gonorrhea, caused by a specific virus, or was it merely the result of a simple irritation? Ricord taught that gonorrhea was not a specific disease, but was a simple catarrh that might be due to the action of various irritants on the mucous membranes. Indeed, one physician of this period has stated that, in his opinion, gonorrhea might follow the exposure incident to urination in the night air. It is significant, and

<sup>1</sup> Noeggerath, Emil: Die latente Gonorrhœe in weiblichen Geschlecht, Bonn, 1872.

<sup>2</sup> Bernutz and Goupil: Arch. gén. de Méd., March, 1857.

<sup>3</sup> Hunter: *Loc. cit.*



shows the result of Ricord's keen powers of clinical observation, that he regarded the discharges from uterine catarrh, the lochia, and the menstrual flow as peculiarly likely to set up a urethritis, conditions that we now know favor contagion in cases of chronic gonorrhea in women. Under predisposing causes of gonorrhea he mentioned age, sex, temperament, climate, and the season of the year. Certain food-stuffs, such as alcohol, asparagus, salty foods, and rich dishes in general, were likely to set up a urethritis. Among the chief irritants Ricord placed gonorrheal pus first. This he believed would produce gonorrhea, not by its contagiousness, but merely by the irritation it caused. He maintained that a similar effect could be produced by instrumentation of the urethra, by the injection of irritating fluids, sexual excesses in healthy individuals, or even prolonged sexual excitement without gratification. To bear out these conclusions Ricord pointed to the fact that he had frequently seen urethritis in the male, and on examining the female partner had found her entirely healthy and free from disease. He also believed that a patient could in time become accustomed to the irritant, and might thus cohabit with the infected woman without harmful results, whereas another would immediately develop a gonorrhea—a fact that is now well established. Ricord believed that blondes are more susceptible to gonorrhea than brunettes, and that women with leukorrhea are prone to be infectious. He thought that rich foods, alcohol, especially the white wines, frequent intercourse, a subsequent warm bath, and urethral injection were factors that favored infection.

As late as 1883 Mr. Henry Lee, in an article in "A System of Surgery" edited by Holmes, makes a statement confirming Ricord's views, and concludes as follows: "Gonorrhea often arises from intercourse with women who themselves have not the disease."

To return, however, to the time of Ricord: We find that there were two distinct schools regarding the genesis of gonorrhea—the one believing with Ricord that urethritis resulted from a simple irritation, and the other that the virus of gonorrhea was the etiologic factor. These contrary theories led to the performance of many experiments. Voillemier<sup>1</sup> anointed a sound with pus from an abscess of the neck and introduced this instrument into the healthy urethra of a man, keeping it in place for one hour. No ill results followed. This experiment was repeated upon another individual, except that pus from an abscess of the thigh was used. A negative result was obtained. It was ascertained, however, that when a urethra was inoculated with pus from a urethritis, gonorrhea invariably followed. A similar result was ob-

<sup>1</sup>Voillemier: *Traité des maladies des voies urinaires*, Paris, 1868.

tained with pus from a case of ophthalmia by Thiry, Pauli, Vetch,<sup>1</sup> de Landau, Otis, and Guyomor,<sup>2</sup> all of whom recognized the analogy between the two conditions. Rosolimes<sup>3</sup> and Michaëlis observed that sexual excesses did not produce gonorrhea. Milton,<sup>4</sup> who for many years was the sole practitioner in a small country town, never saw any gonorrhea other than imported cases, and he assures us, as Spooner aptly phrases it, that the inhabitants were not averse to "Wein, Weib, und Gesang." Further arguments were deduced from the fact that virulent gonorrhea had a definite period of incubation and ran a prolonged course, whereas urethritis the result of chemical or traumatic irritants appeared almost immediately and tended toward a rapid spontaneous cure.

In this state the controversy continued for over forty years. Such eminent authorities as Fournier,<sup>5</sup> Acton,<sup>6</sup> Robert,<sup>7</sup> Jullien,<sup>8</sup> Langlebert,<sup>9</sup> Geigel,<sup>10</sup> Muller, Tarnowsky,<sup>11</sup> and Bumstead<sup>12</sup> were among the anti-virulists, and believed that gonorrhea was caused by a simple irritant, whereas among the virulists were Hoelder, Reder,<sup>13</sup> Baumé, Milton,<sup>14</sup> Martin and Belhomme,<sup>15</sup> Lebert, Zeissl,<sup>16</sup> Diday,<sup>17</sup> Sigmund, Auspitz, Durkee, and Duyon.<sup>18</sup>

It was, however, impossible to escape the fact that whenever pus from a virulent urethritis was introduced into a healthy urethra a urethritis followed, and that the resulting infection presented certain clinical characteristics similar to the original case, and differing quite radically from a urethritis caused by a chemical or traumatic irritation. It was also found that the amount of pus used in the inoculation made

<sup>1</sup> Vetch: *Practical Treatise on Dis. of the Eye*, 1820, p. 242.

<sup>2</sup> Guyomor: *Thèse de Paris*, 1858, p. 45.

<sup>3</sup> Rosolimes: *Annales de Dermatologie*, Paris, 1883, p. 20.

<sup>4</sup> Milton: *Gonorrhea*, London, 1876; also *Path. and Treat. of Gonorrhea*, London, 1883, 2.

<sup>5</sup> Fournier: *Dictionnaire de Méd. et de Chir. Pract.*, 1866, Art. *Blennorrhée*.

<sup>6</sup> Acton: *A Practical Treatise on Diseases of the Urinary and Generative Organs*, London, 1851, p. 30.

<sup>7</sup> Robert: *Maladies Veneriennes*, Paris, 1861, p. 64.

<sup>8</sup> Jullien: *Traité Practique d. Mal. Veneriennes*, Paris, 1879.

<sup>9</sup> Langlebert: *Maladies Veneriennes*, Paris, 1864, p. 16.

<sup>10</sup> Geigel, A.: *Geschich. Path. u. Therap. d. Syph.*, Wurzburg, 1867, p. 73.

<sup>11</sup> Tarnowsky: *Vort. ü. ven. Krank.*, Berlin, 1872, p. 87.

<sup>12</sup> Bumstead: *Veneral Diseases*, Phila., 1879, also 1883, p. 56.

<sup>13</sup> Reder: *Path. u. Therap. d. ven. Krank.*, Vienna, 1863.

<sup>14</sup> Milton: *Gonorrhea*, London, 1876; also *Path. and Treat. of Gonorrhea*, London, 1883, 2.

<sup>15</sup> Martin and Belhomme: *Traité Pract. et Elem. de Path. Syph.*, Paris, 1864.

<sup>16</sup> Zeissl, von: *Comp. d. Path. u. Therap. d. prim. Syph. u. einf. ven. Krank.*, Vienna, 1850.

<sup>17</sup> Diday: *Mal. Ven. et Cutanée*, Paris, 1876, p. 4.

<sup>18</sup> Duyon: *Mal. Ven. et Cutanée*, Paris, 1876, p. 4.

no difference, just as virulent a urethritis being caused by an infinitesimal amount as by a large quantity. These facts were strong arguments for the virulists, and as time went on this faction grew stronger. The work of Koch, Hallier,<sup>1</sup> Belhomme and Martin,<sup>2</sup> Pasteur, and Klebs began to make itself felt, and the younger and more scientific men turned to the laboratory in the hope of finding there the proof that would end this lengthy discussion.

In 1658 a Jesuit, Athenasius Kircher,<sup>3</sup> described "vermiculi" in the pus from syphilitics, but what he saw were probably pus- or blood-cells, which up to this time had not been discovered. Deidier,<sup>4</sup> in 1710, believed syphilis to be due to the presence of small maggots: "These hatch and produce others, and in this way we can assume the propagation of the venereal virus. How otherwise can the fact be accounted for that pox could be carried from the Orient into Europe and then pass by commerce with a single prostitute into the French army and thus to France, unless by these venereal worms which are constantly laying great numbers of ova?" "So naïve the conception and so correct is the chain of thought devised that this man divined what could not be proven until two hundred years later" (Finger).

Some authorities believed that the Marseilles epidemic of 1721 was caused by animalcula. Five years later a satire appeared in Paris that threw ridicule upon the entire subject. Certain parasites which he called the "*Vibrio lineola*" and the "*Trichomonas vaginalis*," and which he discerned in gonorrheal leukorrhea, were described by Donne<sup>5</sup> in 1837. For some time these organisms held the field as the cause of vaginitis, but seven years later we find Donne of the opinion that gonorrheal pus differs in no respect from ordinary pus, and that the "*Trichomonas*" which he had described were the inhabitants of the normal vaginal secretion.

At about this period the erroneous view became prevalent that the vagina was the chief seat of gonorrhea in women. If the urethra and bladder were not macroscopically involved, and if no gross changes were found in the vagina, the surgeons of the day were inclined to give the patient a clean bill of health so far as gonorrhea was concerned. In fact, gonorrhea in women was looked upon as a comparatively insignificant disease. Cervicitis, endocervicitis, and uterine lesions were

<sup>1</sup> Hallier: Zeitschrift f. Parasitenk., 1872.

<sup>2</sup> Belhomme and Martin: Traité Pract. et Elem. de Path. Syph., Paris, 1864.

<sup>3</sup> Kircher: Scrutinium Physico-medicinum Contagiones luis, quae pestis dicitur, etc., Rome, 1658.

<sup>4</sup> Deidier: Diss. Med. S. L. Maladies Veneriennes, Paris, 1710, p. 13.

<sup>5</sup> Donne: Rech. Micr. s. l. Natur. d. Mucus c. l. Matier d. divers Ecouls. d. Organ. Genito-urin., etc., Paris, 1837, also Cours d. Micros., 1844, p. 201.

classed as uterine catarrh, a condition believed to be quite separate and distinct from gonorrhea. By only a few observers had the connection between pelvic peritonitis and gonorrhea been even hinted at. It requires but little imagination to grasp the vast social importance of this mistaken viewpoint of the pathology of gonorrhea. In the male, pus was regarded as the infective agent, and while this was present in a urethritis, intercourse was interdicted. The opinion advanced by Lee, that "so long as any discharge exists, sexual congress is unsafe," was not generally accepted, and may be looked upon as representing the most advanced view of this period. "Not only does the medical world believe that a so-called cured gonorrhea is actually cured, but they are even of the opinion that a man who has a gleet (Nachtripper) may not infect his wife. It is usual, at the present time, among the best informed practitioners (non-specialists), to sanction marriage in the case of men who still continue to observe adhesions of the urethral orifice and staining of the linen, as *beaux restes* of a gonorrhea. Even the highest authorities, as Professor A. Geigel,<sup>1</sup> permit the cohabitation with the newly married wife of a man, the subject of gleet, so soon as the urethral discharge appears perfectly clear" (Noeggerath<sup>2</sup>). This quotation has been introduced in full, as it exemplifies so thoroughly the general opinion of the medical profession regarding the contagiousness of gonorrhea at this period.

In 1872 Emil Noeggerath,<sup>3</sup> a German physician and former practitioner in New York, published a work on gonorrhea that was destined to revolutionize the view of the medical world regarding the clinical significance of the disease, more especially of gonorrhea in the female. Unfortunately for English readers this treatise was published in German and has never been translated. This may, in part, account for the slow recognition which this epoch-making monograph received. This writer's views regarding gonorrhea were in some respects exaggerated, and, like many another man in a similar position, these portions of his paper were widely quoted and branded as false, whereas the wide-reaching and accurate clinical observations were allowed to pass more or less unnoticed. Noeggerath was the first to insist that inflammation of the uterus and appendages was the direct result of gonorrhea, and that gonorrhea was extremely intractable to treatment; that it often remained latent for months or years before causing severe complications, and that infection the result of sexual intercourse might result after long periods of quiescence. Of this he writes: "Of

<sup>1</sup> Geigel: *Geschich. Path. u. Therap. d. Syph.*, Würzburg, 1867, p. 73.

<sup>2</sup> Noeggerath, Emil: *Die latente Gonorrhöe in weib. Geschlecht*, Bonn, 1872.

<sup>3</sup> Noeggerath: *Loc. cit.*

one hundred women who become the wives of men who have formerly been afflicted with gonorrhea, scarcely ten remain healthy. The rest suffer from one of the ailments which it is the task of this treatise to describe." To bear out these conclusions he presents notes of 50 selected cases. His classification of intraperitoneal pelvic gonorrhea—into: (1) Acute perimetritis; (2) recurrent perimetritis; (3) chronic perimetritis; and (4) oöphoritis—was undoubtedly faulty. Nevertheless his conception of the nature of gonorrhea was correct; thus he says: "A woman who at any time in her life has had an acute gonorrhea has to expect at some more or less distant period—it may be a month or a year—a subsequent attack of peritonitis in some form, and that the wife of a man who has ever suffered from gonorrhea is, with regard to an attack of perimetritis, in the same position as if she herself had had an acute gonorrhea." He dwells strongly on this point, and goes on to say: "The young, hitherto healthy wife, begins to complain a few weeks after marriage. Menstruation commences to be more profuse than formerly, accompanied by dysmenorrhea. Leukorrhea becomes more or less excessive, especially after the periods. This gradually increases, ultimately becoming continuous without intermission until the next menstruation begins. After a few months severe pain commences in either or both sides of the pelvis, and the sufferer is ultimately compelled, on account of fever and unbearable burning pains in the abdomen, with increased leukorrhea, to take to her bed and send for medical assistance. According to the severity of her attack she remains confined to her bed for weeks or perhaps for months, with exhausted strength, struggling for life, ultimately recovering, but remaining sterile and invalided for the remainder of her days." Noeggerath points to the frequency with which sterility follows gonorrheal infections in women, and shows that when pregnancy does occur, the subsequent labor is often followed by sepsis. There can be no doubt that during this period gonorrhea was extremely prevalent in New York. Nevertheless, the statement of Noeggerath, that 80 per cent. of married men have had gonorrhea at some time during their lives, that 90 per cent. of these are cured, and that 60 per cent. of all married women have been infected with gonorrhea, seems to be the view of a pessimist. The conclusions he arrived at in this masterly essay are as follows:

1. Gonorrhea in the man, as well as in the woman, persists for the whole lifetime, in spite of apparent cure.
2. Latent gonorrhea occurs in man as well as in woman.
3. Latent gonorrhea in the man, as well as in the woman, may

evoke in a hitherto healthy individual either a latent or an acute attack.

4. Latent gonorrhea in the woman manifests itself in the course of time by perimetritis, acute, chronic, or recurrent, or by oöphoritis, or as a catarrh of some definite portion of the genital mucous membrane.

5. The wives of men who at any time in their lives have had gonorrhea are, as a rule, sterile.

6. Such women, if they do become pregnant, either abort or bear but one child. Only very exceptionally are more born.

7. From the discharge of a woman affected with latent gonorrhea a fungus may be cultivated that is analogous to that obtained from the discharge of acute gonorrhea.

Noeggerath lived to modify his views regarding the prevalence and incurability of gonorrhea. It is certain that he strongly suspected the nature of the etiologic factor of gonorrhea, and that had he been familiar with Koch's methods of investigating microörganisms, Neisser's discovery might have been anticipated by seven years. In the year following the appearance of Noeggerath's work Macdonald<sup>1</sup> published a paper strongly confirming the views of the former. But with the caution for which his countrymen are noted, Macdonald hesitated to confirm all Noeggerath's extreme opinions. In writing of the etiology of gonorrhea, Macdonald made this prophetic statement: "It does not seem in the least Utopian to anticipate that some day we shall be able to see with the microscope the germs, whether they be one or many species, which give rise to the blood changes which give rise to puerperal fever and other septicemic disorders."

In reviewing the history of gonorrhea, there are three men whose names stand out above all others. The first of these is Ricord, who definitely established the identity of gonorrhea, and thus placed its treatment and that of syphilis, with which it had previously been confounded, upon a sound basis. The second great advance in the study of this disease is due to the epoch-making monograph of Noeggerath. The latter's work was strictly clinical; to him we are indebted for establishing the relationship existing between pelvic peritonitis and gonorrhea, for pointing out the long-continued contagiousness of this disease, its latency, and its devastating results with regard to sterility and puerperal infection. The third name in this great triad is that of Neisser. Noeggerath was fortunate in having Neisser's discovery come when it did, for it enabled him to confirm his clinical work by exact laboratory researches. As Bumm has happily remarked, "Noeggerath was more fortunate than Semmelweis: he lived to see

<sup>1</sup> Macdonald, Angus: *Edinburgh Med. Jour.*, June, 1873.



the triumph of his observations. For this he has to thank Neisser, who soon after discovered the gonococcus and made possible the certain proof of his statements relative to the frequency of the lesion."

Early in 1872 Hallier<sup>1</sup> reported the finding of a micrococcus in gonorrheal pus. Some of these cocci were free and others were intracellular. Owing to insufficient laboratory facilities, such as staining, illuminating, and magnifying, these results attracted little attention, and to Neisser,<sup>2</sup> seven years later, is very properly attributed the honor of the discovery of the gonococcus.

Another name that has been more or less overlooked in this connection is that of Salisbury,<sup>3</sup> who, in 1868, stated that for six years he had been examining the urethral discharges from cases of urethritis. Salisbury writes: "I had not been pursuing this mode of inquiry long before I discovered spores which were scattered about free in the pus and in the epithelial cells. . . . These spores are very minute and well defined; they are often discovered in twos and sometimes in fours. . . . In some instances the pus-cells become filled with the spores." This observer obtained his material for examination by scraping the urethra. It seems that, undoubtedly, he really saw the gonococci, but failed to receive proper recognition through lack of proper staining methods. He also described filaments which he believed resulted from the "spores." He believed that every drop of gonorrheal pus contained specific poison. His illustrations, while showing some of the spores in pairs, present others that appear in groups, without definite pair formation. His description is, however, convincing.

On July 12, 1879, Albert Neisser, at that time an assistant in the University Clinic of Dermatology at Breslau, described a micrococcus that he believed to be the cause of gonorrhea. His conclusions were drawn from the study of 35 cases. In only one case of urethritis in the male was the micrococcus not found, and this case was suspected from the first of being one of urethral chancre. In 9 cases of urethritis in the female the micrococcus was found in all. It was also demonstrated in 7 cases of purulent ophthalmia. Control examinations were made, but in no case was the micrococcus discovered. To demonstrate these micrococci Neisser employed the method of Koch. A small drop of pus was spread thinly over a cover-glass and allowed to dry. It was then stained with an aqueous solution of methyl-violet and again put aside until dry. Neisser described the micrococci and their method of division accurately. This discovery, coming as it did at

<sup>1</sup> Hallier: *Zeitschr. f. Parasitenk.*, 1872.

<sup>2</sup> Neisser: *Cent. f. d. med. Wissen.*, July 12, 1879.

<sup>3</sup> Salisbury, J. H.: *Amer. Jour. Med. Sci.*, 1868, pp. 17-25.

a time when the Germans were so confidently expecting great results from the new era of bacteriology introduced by Koch, attracted universal attention, and many investigators immediately took the field. Cheyne<sup>1</sup> reported that in 1879 he had discovered the gonococcus. Unfortunately, his publication did not appear until July 24, 1880. In 1880 Weis observed gonococci in the pus from 35 cases of urethritis. In only one case of urethral discharge were the gonococci not found, and this proved later to be a case of urethral chancre. He endeavored to find gonococci in the leukorrhea from 35 cases, but failed in every instance. In 1882 Neisser<sup>2</sup> published a second paper, in which he confirmed nearly all his previously published views. He insisted that the micrococcus previously described by him differed functionally and morphologically from all other organisms. He showed that the gonococci could be cultivated on artificial media, and that he himself had grown them for seven generations on cultures made from meat extract, peptone, and gelatin of neutral reaction. Numerous experiments that he made on lower animals all failed. From 1879 to 1886, or even later, the literature relating to the gonococcus is extremely abundant. Thus Bumm<sup>3</sup> mentions that there were 52 contributions on this subject up to the beginning of 1886, and Sinclair<sup>4</sup> found 40 papers on ophthalmia neonatorum alone abstracted in the *Centralblatt für Gynäkologie* from 1881 to 1886. As might have been expected, all Neisser's conclusions were not immediately accepted. Even so late as 1890 considerable doubt still existed in the minds of many investigators regarding the rôle played by the gonococcus in the production of gonorrhea.

Bokai and Finkelstein<sup>5</sup> (1880) found micrococci constantly present in gonorrheal pus and in the secretion of ophthalmia. They made cultures, and from these inoculated the urethras of 6 medical students. Of these, 3 developed gonorrhea. In 1 of the 3 negative cases the urethral discharge was found to contain oil of eucalyptus, which is toxic to gonococci. In the other 2 cases the failures were probably due to faulty technic. During this year (1880) further confirmatory work appeared from Ehrlich,<sup>6</sup> Rucker,<sup>7</sup> Aufrecht,<sup>8</sup> and Gaffky. In

<sup>1</sup> Cheyne: *Brit. Med. Jour.*, July 24, 1880, p. 114.

<sup>2</sup> Neisser, A.: *Deut. med. Wochenschr.*, 1882, vol. xiii, p. 279.

<sup>3</sup> Bumm: *Beit. z. Kenntniss d. Gonococcus*, Wiesbaden, 1885; also *Der Mikroorganismus d. gonorrhöischen Schleimhaut-Erkrankungen*, Gonococcus Neisser, second edition, Wiesbaden, J. F. Bergmann, 1887.

<sup>4</sup> Sinclair, N. J.: *On Gonorrheal Infections in Women*, in *Wood's Med. and Surg. Monographs*, 1889, vol. i.

<sup>5</sup> Bokai and Finkelstein: *Orvosi Heli lap*, May 16, 1880; also *Pester Med.-Chir. Presse*, June 20, 1880.

<sup>6</sup> Ehrlich: *Zeit. f. klin. Med.*, 1881, vol. ii, p. 70.

<sup>7</sup> Rucker: *Deutsch. med. Wochenschr.*, 1880.

<sup>8</sup> Aufrecht: *Path. Mittheil.*, Magdeburg, 1884, p. 147.



1881 Hirschberg and Krouse<sup>1</sup> found the gonococcus in all cases of ophthalmia neonatorum examined, but claimed to have discovered morphologically similar micrococci in the vaginal secretion of healthy women. Haab<sup>2</sup> also found the gonococcus present in the pus from a large series of cases of ophthalmia neonatorum. Slatter<sup>3</sup> and Langlebert<sup>4</sup> confirmed Neisser's conclusion. In 1882 Leistikow,<sup>5</sup> an assistant in the clinic for syphilis in the Berlin Charité Hospital, studied gonococci in the discharges from 200 cases of urethritis, 3 cases of ophthalmia in adults, and 4 cases in children. As a result of his investigation this writer came to the conclusion that the microscopic demonstration of the presence of the gonococci absolutely proved the character of the infection. Krouse<sup>6</sup> (1882) and Königstein<sup>7</sup> (1882) experimented by means of cultures and inoculations. In almost all cases in which cultures were inoculated into the eyes of animals, negative results were obtained. Königstein did not agree with Neisser in believing that the diplococcus was characteristic of a gonorrheal inflammation of a mucous membrane. Ecklund<sup>8</sup> asserted that he found gonococci in the secretions from cases of stomatitis, chronic enteritis, and even of inflammation of the lungs. It is very evident, from his paper, that his conclusions were drawn as much from his imagination as from fact. In the following year (1883) Bockhart,<sup>9</sup> of Würzburg, accurately demonstrated for the first time the pathologic changes produced by the gonococcus. With a pure culture of this micrococcus he inoculated the healthy urethra of a forty-six-year-old male paralytic, whose death was daily expected. Two days after the injection of the gonococci the meatus became red and swollen, and by the sixth day a well-developed purulent urethritis was present. This increased in severity until the twelfth day, when the patient died. From the third day following the inoculation gonococci in pure culture were secured daily from the urethral discharge. From a microscopic examination of the tissues of the urethra Bockhart<sup>10</sup> concluded that the gonococci penetrated between the epithelial cells into the lymph-spaces of the mucosa and submucosa of the fossa navicularis, and that they here

<sup>1</sup> Hirschberg and Krouse: *Cent. f. prakt. Augenheilk.*, 1881, vol. v, p. 39.

<sup>2</sup> Haab: *Cent. f. prakt. Augenheilk.*, September, 1881; *Correspondenzbl. f. Schweizer Aerzte*, vol. ii, p. 80, *Festschr.*, Wiesbaden.

<sup>3</sup> Slatter: *Sitzungsber. d. XIV. Ophthal. Gesellsch. in Heidelberg*, pp. 9, 54.

<sup>4</sup> Langlebert: *Maladies veneriennes*, Paris, 1864, p. 16.

<sup>5</sup> Leistikow: *Charité-Annalen*, Berlin, 1882, vol. vii, p. 750.

<sup>6</sup> Krouse: *Cent. f. Augenheilk.*, 1882.

<sup>7</sup> Königstein: *Vortrag, gehalten in d. K.K. Gesell. d. Aerzte*, Vienna.

<sup>8</sup> Ecklund: *Annal. d. Dermat.*, Paris, 1882, vol. iii, p. 540.

<sup>9</sup> Bockhart, M.: *Viertelj. f. Dermat. u. Syph.*, Vienna, 1883, vol. x, p. 3.

<sup>10</sup> Bockhart: *Sitzungsbericht d. phys. med. Gesellschaft zu Würzburg*, 1883, No. 1.

multiplied and set up a leukocytosis; that the gonococci entered the white blood-corpuscles, and were thus disseminated to various tissues. Young<sup>1</sup> has questioned the correctness of the bacteriologic diagnosis of this case.

Bockhart also published a report demonstrating the presence of gonococci in the discharges of 258 cases of chronic urethritis. Four years later (1886) Bumm gives the following description of the histologic picture produced by the gonococcus, and its means of dissemination from the surface to the deeper layers: The infecting secretion conveys a certain number of gonococci to the mucous membrane. These penetrate the layers of epithelial cells, and reach the papillary body of the mucous membrane, passing through and between the protoplasm and cement substance of the epithelial elements. Swarms of white blood-corpuscles emigrate at this time from the dilated capillary network, which extends almost to the epithelial covering, and penetrate into the upper stratum of the connective tissue, whence, laden with gonococci, they pass through the epithelium to the surface. The epithelial stratum, whose firmness is destroyed by the proliferation of cocci, becomes fissured by the stream of fluid accompanying them and rises in clumps; this process may be aided by capillary hemorrhages between the epithelium and cellular tissue. The distribution of the cocci is confined to the superficial layers of the subepithelial cellular tissue, where they are arranged between the fibers in rows or round colonies. While the micrococci increase in this manner in the outermost layers of the connective tissue, the inflammatory symptoms increase in intensity, and the round-cell infiltration finally occupies the entire papillary body, cell being closely applied to cell. This furnishes the transition to the purulent stage, in which the majority of the gonococci are washed away by the abundant suppuration. After a variable time regeneration begins to take place from the remains of the original epithelium, and by its extension puts an end to the further spread of the cocci in the tissue, whereas the migration of the pus-cells, which carry off the remainder of the cocci, proceeds uninterruptedly. With the regeneration of the epithelium are usually associated proliferating processes, from the lowermost layers of which epithelial papillæ grow into the connective-tissue substratum. At this time the cocci, with the aid of the pus-cells, have disappeared from the papillary bodies, and are found only in the upper layers of the epithelial covering. But if the fresh epithelial covering cannot withstand an invasion of migrating round cells induced by

<sup>1</sup> Young, H. H.: *The Gonococcus: Report of Successful Cultivations*, Contributions to the Science of Medicine, dedicated by his pupils to W. H. Welch, Baltimore, 1900, p. 677.

external irritants, its continuity will suffer, and a new lesion of the papillary body produced by coeci will take place—*i. e.*, a relapse occurs. During the latter part of the purulent stage and during the entire mucopurulent stage the proliferation of gonococci takes place outside of the tissues, upon the surface of the epithelium and in the secretion.

Corroborative evidence of the etiology of gonorrhea and ophthalmia neonatorum appeared at about this time (1882) from the pen of Esehbaum,<sup>1</sup> Newberry,<sup>2</sup> Bareggi, Marchiafava,<sup>3</sup> Campona, and Keyser.<sup>4</sup> The last of these writers examined the urethral discharge from 64 cases of urethritis,—30 whites and 34 negroes,—and found the gonococcus in all. They were absent in 3 other cases, 2 of which had been treated, and in the third little discharge was obtainable. In 1883 Sternberg<sup>5</sup> appears to have mistaken the *Micrococcus catarrhalis* for the gonococcus, and as a result denied the specific character of the latter. Welander<sup>6</sup> examined 144 cases of urethritis in the male and 79 in the female, and demonstrated the presence of gonococci in all. He also performed the following experiment: He utilized 3 women suffering from urethritis, but in whom the vaginal secretion was free from gonococci. He inoculated the vaginal discharge from these subjects into the urethras of 3 men. None of these contracted gonorrhea; later these, and a fourth individual, were exposed to the secretion from the urethra from the same women. Gonorrhea resulted in all. In 21 confrontations, gonococci were found in both partners. Additional confirmatory proof of Neisser's discoveries was obtained by Chaméron,<sup>7</sup> Wyssokowich and Belleli,<sup>8</sup> the last named making his investigations in an examination bureau for prostitutes. In 1884 an important series of experiments were conducted by Zweifel.<sup>9</sup> The lochia from 6 normal cases, having first been found to be microscopically free from gonococci, was, with certain precautions, inoculated into the eyes of healthy infants. In none did ophthalmia neonatorum result. This observer therefore believed that only lochia containing gonococci could cause ophthalmia neonatorum. Bunum<sup>10</sup> reported having constantly found gonococci in the lochia of mothers whose infants suffered

<sup>1</sup> Esehbaum: Deut. med. Woch., Berlin, March, 1883, p. 187.

<sup>2</sup> Newberry: Maryland Med. Jour., 1882, vol. ix, p. 481.

<sup>3</sup> Marchiafava: Gazz. degli Osped., ann. 3, No. 21.

<sup>4</sup> Keyser: Maryland Med. Jour., 1882, vol. ix, p. 481.

<sup>5</sup> Sternberg: Med. News, Phila., 1883, vol. xlii, pp. 67, 96.

<sup>6</sup> Welander: Monats. f. prakt. Dermat., 1884, vol. iii, p. 125.

<sup>7</sup> Chaméron: Thèse de Paris, 1884, No. 346, pp. 35, 37.

<sup>8</sup> Belleli: Unione Med. Equis., Alexandria, 1884, 1, No. 8.

<sup>9</sup> Zweifel: Arch. f. Gyn., 1884, vol. xxii, p. 318.

<sup>10</sup> Bunum: Der Mikro-organismus der gonorrhöischen Schleimhaut-Erkrankungen, Gonococcus Neisser, second edition, Wiesbaden, 1887.

from ophthalmia neonatorum. Arning,<sup>1</sup> working in Neisser's clinic, discovered gonococci in the pus from Bartholinian abscesses in 8 cases of gonorrhea. Kammerer<sup>2</sup> claims to have found gonococci in the fluid of gonorrheal arthritis. Aubert<sup>3</sup> found the gonococcus in 200 cases of suspected gonorrhea, and believed that this organism was the most frequent cause of urethritis. Gama Pinto<sup>4</sup> denied the specific character of the gonococcus, declaring that he found morphologically similar micrococci in the pus from various conditions. As the result of a study of 92 cases of ophthalmia neonatorum Kroner<sup>5</sup> came to the conclusion that there were two forms of ophthalmia—one, caused by the gonococcus, and the other, the result of a bacterium. He also found gonococci present in the lochia from 18 out of 21 mothers, whose infants suffered from ophthalmia neonatorum. Paul published a paper proclaiming the virulence of the gonococcus. Icard<sup>6</sup> (1884) describes cases of urethritis due to microorganisms other than gonococci. Sanger<sup>7</sup> stated, before the German Natural Science and Medical Association of Magdeburg, in 1884, that the hope aroused by Neisser that the gonococcus would be the means of diagnosing chronic gonorrhea had proved vain. He believed that it was an established fact that gonorrhea might exist without the presence of gonococci being demonstrable. He went further, and stated that, in view of the occurrence of non-pathogenic forms of diplococci, the presence of the gonococcus did not prove the gonorrheal nature of the disease. Fränkel<sup>8</sup> also believed that, as there were various forms of cocci in the genital secretions of the female, culture and inoculation were the surest means of differentiating their clinical nature. Widmark<sup>9</sup> examined 13 cases of purulent ophthalmia, 12 in infants and 1 in an adult. In the secretion from 10 of these gonococci were found. In 2 cases of urethritis in young girls in which gonococci were demonstrated the parents had gonorrhea, and in the urethral secretion of both mothers gonococci were found. Oppenheimer<sup>10</sup> studied the influence of various gonococci upon pure cultures of gonococci. Lundstroem<sup>11</sup> (1885) examined the discharges of 50 cases of acute and chronic urethritis and found gonococci in all. Similar results were obtained by Kries (1885).

<sup>1</sup> Arning, E.: Vierteljahresschr. f. Derm. u. Syph., 1884, vol. x.

<sup>2</sup> Kammerer: Cent. f. Chir., 1884, No. 4.

<sup>3</sup> Aubert: Lyon méd., July 13, 1884.

<sup>4</sup> Pinto: Med. Contemp., June 8 and 15, 1885.

<sup>5</sup> Kroner: Amer. Jour. Bact., 1885, vol. viii, p. 197.

<sup>6</sup> Icard: Lyon méd., 1884, No. 81.

<sup>7</sup> Sanger: Arch. f. Gyn., 1884, vol. xxv, 1.

<sup>8</sup> Fränkel: Deut. med. Woch., 1885, No. 2.

<sup>9</sup> Widmark: Arch. f. Kinderheilk., 1885, No. 7.

<sup>10</sup> Oppenheimer: Arch. f. Gyn., vol. xxv, No. 1.

<sup>11</sup> Lundstroem: Studier Öfver Gonoc. (Neisser), Helsingfors, 1885; also Monats. f. prakt. Derm., 1885, vol. iv, p. 455.

Cseri,<sup>1</sup> of Budapest, reports that from 1883 to the date of the appearance of his paper (1885), the discharge from 26 children suffering from contagious colitis had been examined microscopically, and a large diplococcus, similar to Neisser's gonococcus, had been found in nearly all cases. This discharge, when inoculated into the eye, produced an ophthalmia. The same writer relates the case of a near-sighted nurse who, while douching one of these children, accidentally introduced some of the vaginal discharge into her eye. An ophthalmia followed that resulted in the loss of the organ. Frankel<sup>2</sup> also found, in the vaginal discharge of children, diplococci which he described as identical with the gonococci of Neisser, and he believed these children to be free from gonorrhea. An excellent review of the French literature relating to the gonococcus was published by Martineau<sup>3</sup> in 1885. He claims for Bouchard precedence by one year in the discovery of the gonococcus. His arguments are, however, unconvincing, and no proof is brought forward to substantiate the claim. During this year (1885) further confirmatory evidence regarding the virulence of the gonococcus appeared as the result of the work of Ferarri,<sup>4</sup> Bouchard, De Pezzer,<sup>5</sup> de Sinety and Henneguy.<sup>6</sup> In 1886 a number of observations appeared showing that a purulent urethritis might occur as the result of micrococci other than the gonococci. Thus, Bochart<sup>7</sup> reports that in four years he has seen 15 such cases, basing his conclusions upon cultures and inoculations. Similar conclusions were adduced by Peterson,<sup>8</sup> Podres,<sup>9</sup> and Crevelli.<sup>10</sup>

During the next year Zeissl<sup>11</sup> found a micrococcus resembling the gonococcus in the discharge from cases of non-gonorrheal suppurating urethritis. Abelaender, Wendt, Giovannini,<sup>12</sup> Lustgarten and Mannaberg<sup>13</sup> report finding a diplococcus in the normal urethra. These organisms were both intracellular and extracellular. All doubt as to the virulence and specificity of the gonococcus was finally set at rest

<sup>1</sup> Cseri, J.: *Wien. med. Woch.*, 1885, No. 22 and 23.

<sup>2</sup> Frankel: *Deut. med. Woch.*, 1885, No. 2.

<sup>3</sup> Martineau: *Ann. Med. Chir. Franc. et étrang.*, 1885, vol. i, p. 5; also *La cliniq. sur la Blennor. chez la Femme*, 1885.

<sup>4</sup> Ferarri: *Gior. di Med.*, 1885, vol. xxxiii, p. 337.

<sup>5</sup> De Pezzer: *Annal. des Mal. d. Org. Gen.-Urin.*, 1885, vol. iii, p. 95.

<sup>6</sup> de Sinety and Henneguy: *Mém. de la soc. de Biol.*, August 8, 1885, p. 553.

<sup>7</sup> Bochart: *Monats. f. prakt. Dermat.*, 1886, vol. v, p. 134.

<sup>8</sup> Peterson: *St. Petersburg Deut. med. Zeit.*, 1885, vol. vi, p. 517.

<sup>9</sup> Podres: *Vierteljahresschr. f. Dermat.*, Vienna, 1885, p. 557.

<sup>10</sup> Crevelli: *Thèse de Paris*, 1886; also *Australian Med. Jour.*, 1888, p. 89.

<sup>11</sup> Zeissl, von: *Comp. d. Path. u. Therap. d. prim. Syph. u. einf. vener. Krank.*, Vienna, 1880.

<sup>12</sup> Giovannini: *Gaz. degli Osped.*, Milan, 1886, No. 91.

<sup>13</sup> Lustgarten and Mannaberg: *Vierteljahresschr. f. Dermat. u. Syph.*, 1887, p. 905.

by the appearance of Bumm's<sup>1</sup> masterly paper, in which he adduced abundant material and incontrovertible proof of the verity of his conclusions. In a paper published in 1888 Schnurmans-Stekhoven<sup>2</sup> questions Bumm's results, and expresses doubt as to the existence of a specific micrococcus of gonorrhea. He bases his attack on the ground that Bumm had not proved that the cultures used by him were pure. Papers tending to prove that a urethritis might be produced by a number of micrococci other than the gonococcus were published by Rauzier,<sup>3</sup> Pouey,<sup>4</sup> and Legrain<sup>5</sup> during 1888.

In the following year Steinschneider and Galewsky<sup>6</sup> isolated from four normal urethras a diplococcus morphologically analogous to the gonococcus.

Rovsing<sup>7</sup> (1890) reported finding the *Diplococcus ureæ non-pyogenes* in the discharge from the normal female urethra. As might have been suspected, the finding, by so many trustworthy investigators, of diplococci morphologically similar to the gonococcus in discharges from undoubtedly normal urethras created much confusion. Fortunately, in the next year (1891) Wertheim's method of preparing cultures of the gonococcus permitted so many positive inoculations to be made as to close forever the discussion as to the pathogenic character of the gonococcus.

No historic sketch on gonorrhea, however brief, would be complete without a reference to the wonderful skill and genius of Lawson Tait, who performed much of the pioneer work in the surgery of pelvic inflammatory disease. He recognized the tubal origin of these cases, and the results of the "Tait operation," as salpingo-oöphorectomy for adnexitis was called, were so brilliant as to attract general attention throughout the entire surgical world.

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<sup>2</sup> Schnurmans-Stekhoven: Deut. med. Woch., 1888, No. 35, p. 717.

<sup>3</sup> Rauzier: Gaz. Hebdom. d. Soc. Med. d. Montpellier, February, 1888.

<sup>4</sup> Pouey: Thèse de Paris, 1888, No. 262.

<sup>5</sup> Legrain: Thèse de Nancy, 1889; also Annal. des Mal. d. Org. Gen.-Urin., 1888, p. 523, etc.

<sup>6</sup> Steinschneider and Galewsky: Verh. d. Deut. Dermat. Gesell., Vienna, 1889, vol. i, p. 159.

<sup>7</sup> Rovsing: Die Blasenentzündung, etc., Berlin, 1890.

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## CHAPTER II

### BACTERIOLOGY OF THE GONOCOCCUS

THE gonococcus, discovered by Neisser in 1879, is the specific cause of gonorrhea. So conclusively has this been proved, that wherever this micrococcus is found, a positive diagnosis can be made. In the chronic, or so-called latent, cases, especially in the female, it is sometimes extremely difficult to demonstrate the gonococcus, and for this reason negative bacteriologic results, unless frequently repeated and performed under favorable circumstances, cannot positively exclude the gonorrheal nature of the disease.

It has been shown that the gonococcus is not a single organism, but a group of organisms. This accounts for the fact that autogenous vaccines have proved most successful, and that polyvalent serum is superior to that prepared from a single strain of gonococci. This fact also explains, to a certain extent, the difference in severity that occurs in different cases of gonorrhea. In another place references have been quoted that tend to show that certain strains of gonococci are more prone than are others to produce septicemic or metastatic manifestations of the disease.

**Morphology.**—The gonococcus is a coffee-bean-shaped organism; it occurs most frequently in pairs, sometimes in tetrads, and more rarely in groups of 8. The flat, or sometimes slightly concave, sides of the organism are approximated, a narrow space being visible between the halves of the cocci. The organism is frequently spoken of as being kidney, D-, or biscuit-shaped, the Germans likening its form to that of their "Semmel." Unstained, and examined with a low power, the gonococcus appears as a round or slightly elongated organism, about  $1.25\mu$  in length by  $0.7\mu$  in breadth, the double nature of which cannot be distinguished.

Owing to their method of fission, the grouping of the gonococci is characteristic. The older cocci lengthen out, become constricted in the middle, and finally divide, to form a new pair, the division taking place at a right angle to the median fissure, so that one diplococcus develops two double pairs. At first the young organisms are spheric, but as they grow older, the inner surfaces become flattened or slightly concave. As a result of this method of multiplication the gonococci



in film specimens are seen to occur in a discrete group or clump, never in a chain. The number of cocci in each group is usually divisible by 4. Perhaps 20 or more gonococci may be observed somewhat closely packed together, whereas the remainder of the field will be entirely free from these microorganisms. Near the center of the group the cocci are usually more closely aggregated than toward the periphery. This grouping is similar to the pattern made by a closely choked shotgun. The gonococci are found both intracellularly and extracellularly, but are never seen within the nucleus. The intracellular location is the more characteristic. This intracellular quality of the gonococcus doubtless, to a certain extent, accounts for the peculiar chronicity of the disease, as intracellular microorganisms are necessarily less susceptible to the action of germicides than are those that lie free in the secretion.

**Dimensions of the Gonococci.**—The diameter of the associated pair of cocci varies, with the stage of their development, from  $0.8\ \mu$  to  $1.6\ \mu$  in the long diameter, by  $0.6\ \mu$  to  $0.8\ \mu$  in the short diameter, the average being about  $1.25\ \mu$  in the long diameter by  $0.7\ \mu$  in the short. There are undoubtedly many strains of gonococci, and these vary somewhat in size, just as individuals of the same strain do in different generations, when grown upon artificial media.

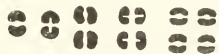


FIG. 1.—METHOD OF REDUPLICATION OF THE GONOCOCCUS.

**Motility.**—The gonococcus is generally believed to be non-motile, although J. Eisenberg credits the organism with a rotary or oscillatory movement. It is certain, however, that the gonococcus is not autolocomotive.

**The Relation of the Number and Morphology of the Gonococci to the Stage and Virulence of the Disease.**—The first discharge, the result of a gonorrheal infection, is made up of mucus, epithelial cells, red blood-corpuscles, and debris. In this the gonococci are found in varying numbers, frequently quite abundantly. The majority of organisms are free in the serum, but they may be agglutinated upon or found within the epithelial cells. For diagnostic purposes it is important to demonstrate the intracellular microorganisms. This is sometimes quite difficult, as at this stage intracellular gonococci are comparatively rare. When a group of diplococci are found on a cell, individual organisms may, as a rule, be seen overlapping the cell edges, whereas when the gonococci are actually within the cell, this is not the case. The different planes that can be demonstrated by focusing will also usually clear up this point. At this stage the gonococci are nearly all of the well-known coffee-bean shape. As the disease

develops and the discharge becomes mucopurulent, the number of gonococci increases quite markedly, and the proportion of intracellular cocci becomes much greater. During the height of the inflammation all the cellular constituents of the discharge diminish in proportion to the pus-cells, which now dominate the field. On account of the great number of pus-corpuses, the number of the gonococci appears to be diminished. This, however, is not the case. At this stage nearly all the gonococci are intracellular—indeed, some authorities maintain that all the extracellular gonococci that are found are the result of trauma in preparing the film, and are caused by the freeing of the original intracellular organism during attempts to make a very thin film of the preparation. That this is not the case we have demonstrated a number of times in films that have been prepared without inflicting any trauma whatever. Large numbers of gonococci are sometimes found within a single epithelial cell or pus-corpusele. As many as one hundred have been counted, and although these cells sometimes appear as if ready to burst, as a general rule they present remarkably little evidence of injury. Discussion is still rife as to whether the gonococci actually invade the pus-cell or are taken up by them as the result of phagocytic action. The former seems the more probable theory, as there is no evidence to prove that the gonococci are destroyed by the pus-corpusele, whereas, on the contrary, it is easy to demonstrate that they multiply readily within the cell. Moreover, the fact that they are found within epithelial cells that have no phagocytic action whatever strengthens this view. According to Bumm,<sup>1</sup> the invasion of the epithelial cells and leukocytes is due to a vital activity on the part of the microorganisms. Large numbers are sometimes present. Scholtz,<sup>2</sup> Pollock and Harrison,<sup>3</sup> and others believe that intracellular gonococci are the result of phagocytosis, and that this process occurs in the free secretion and not in the depths of the tissue, and state that if the surface discharge be wiped off and exudate expressed from the depths of the tissue, extracellular organisms are chiefly found.

During the terminal stage the number of gonococci and pus-cells is diminished. Guiteras<sup>4</sup> states that at this time the pus-cells frequently contain fat-granules and show other signs of disintegration. As a rule, in chronic cases, when pus-cells are numerous in the discharge, gonococci can be demonstrated without difficulty, but when pus-cells

<sup>1</sup> Bumm, E.: *Der Mikro-organismus gonorrhöischen Schleimhaut-Erkrankungen*, Wiesbaden, 1885.

<sup>2</sup> Scholtz: *Arch. f. Dermat.*, 1899.

<sup>3</sup> Pollock, C. E., and Harrison, L. W.: *Gonococcal Infections*, London, 1912, p. 63.

<sup>4</sup> Guiteras, R.: *Urology*, D. Appleton & Co., New York and London, 1912, vol. ii, p. 358.

are scanty, the gonococci are few in number. Large numbers of coarse-grained eosinophile cells are generally present about the third or fourth week of the discharge. During the chronic stage pus-cells diminish in number, epithelial elements become more numerous, and the gonococci are lessened in number. In the secretion from the urethra at this stage the so-called "clap shreds" are present. These consist mainly of transient epithelium, mononuclear leukocytes, a few gonococci, and pus-corpuscles. With the diminution in the amount of pus a relatively greater number of extracellular gonococci are found. During the chronic or terminal period involution forms of gonococci are sometimes encountered. These are often granular in appearance, round or irregular in shape, and have varying staining properties. Wynn<sup>1</sup> states that the more active the lesion, the greater are the number of extracellular gonococci present.

Thus we see that the microscope furnishes a very important means not only of diagnosing gonorrhea, but of differentiating between the various stages of the disease. Harmsen<sup>2</sup> and Sireday and Bigart<sup>3</sup> have demonstrated the value of the microscope in this connection.

It has been asserted that the number of gonococci in the secretion in a given case, the previous history of which is known, may be taken as a guide as to the probable course and virulence of the infection. This theory is doubtful, for the gonococci are at no time equally distributed throughout the discharge, and to be of any value whatever, a large number of preparations must be examined. The prolonged continuance of large amounts of pus and of numerous gonococci in the secretion is, however, certainly an evidence of the chronicity of the period of active inflammation. However, clinical manifestations are usually sufficient, at this time, to demonstrate such a condition.

During the stage of active inflammation there is usually no difficulty in demonstrating the gonococci in smear preparations, provided these are properly prepared. Later, however, during the chronic period, this is, unfortunately, far from being the case. At this time gonococci are often found only after a most thorough search. This is true in the male, but is more especially noticeable in the female. A knowledge of how, when, and from where to obtain the secretion to be examined during this stage of the disease is of great aid in clearing up a doubtful diagnosis. In the female, film preparations should be made from the discharge obtained from the cervix, urethra, vulvovaginal glands, and the vagina, although that from the latter is of little value compared to

<sup>1</sup> Wynn: *Lancet*, 1905, vol. i, No. 6, p. 352.

<sup>2</sup> Harmsen: *Zeit. f. Hyg. u. Infektions-Krankh.*, 1906, vol. liii, p. 89.

<sup>3</sup> Sireday and Bigart: *Annal. de Gyn. et d'Obst.*, December, 1905.

that obtained from the other structures named. The times when gonococci are most likely to be found are immediately after the menstrual periods and during the first few days following labor, miscarriage, or abortion, when the lochia is beginning to diminish. It should be remembered that excesses of all kinds, paid at the shrine either of Venus or of Bacchus, are likely temporarily to light up a chronic or latent gonorrhea, and as a consequence gonococci will more readily be found immediately following such periods. When examining patients during periods when gonococci are not likely to be numerous, the passage of a catheter a short distance into the urethra or a slight dilatation of the lower cervical canal will set up a mild traumatic irritation in the discharge, from which the organism can often be easily demonstrated, or the suspected area may be touched with a solid stick of silver nitrate, and in the exudate from the irritation thus produced the organism may be found. If cultures are to be taken, care must be observed that all the silver has disappeared; this is usually the case at the expiration of twenty-four hours. The alcohol test is a favorite one with many genito-urinary specialists, and consists in having the patient drink a few glasses of beer, champagne, or Burgundy for a few days prior to the examination, and a few pickles added to the diet are recommended by some authorities. In the mean time all treatment is suspended. Similar means may be employed as a test for cure, and should be repeated with negative results at least three times before a clean bill of health is given.

The "beer test" is of less value in the female than in the male, as its efficacy depends largely upon producing an irritating urine. As urethritis in women is usually of secondary importance to the cervical infection, the benefit to be derived from this test under such circumstances is somewhat limited. Van de Velde<sup>1</sup> and others state that a diagnostic vaccination often produces an increased secretion in which gonococci are more numerous, and are often thus easily found when they could not previously be demonstrated. When obtaining the secretion from the urethra, the material should be expressed by firm milking movements, as in this way the discharge is obtained from the deeper crypts and glands, and contamination from other bacteria usually present about the meatus is avoided; besides, the secretion is secured from the most recent and freshly inflamed parts. This discharge will be found to contain more gonococci than that secured from the surface, from which point the inflammation has probably passed its acme at the time of examination. For the same reasons, in making films from the cervical secretion, the material should be obtained from

<sup>1</sup> Van de Velde: *Monats. f. Geb. u. Gyn.*, April, 1912.

a point well within the cervical canal, after having first compressed this organ. Frequently a slight irritation, either chemical or traumatic, will be sufficient to set up a mild local irritation, in the discharge from which gonococci can readily be demonstrated after a failure to demonstrate them by ordinary means. In such an event the secretion for examination should not be taken until twenty-four hours afterward, and this is particularly true if the irritation has been produced by an antiseptic, such as a strong solution of silver, which is often used for this purpose. Gonococci are usually absent, or present only in diminished numbers, immediately after treatment by antiseptics. Whenever practicable, it is best to secure the suspected secretion early in the morning. At this time the urethral canal has probably not been washed out so recently by the passage of urine, and, besides, as Finger has pointed out, more excretion is formed at night. This is not so true of patients who are bedfast. In chronic or latent cases it should always be borne in mind that the gonococci are present only in small numbers, and that the amount of secretion examined on a given slide is comparatively infinitesimal; for this reason a number of preparations—at least three or four—should be made from the secretion of each suspected locality, and such examinations, if negative, should be repeated on two or three successive days. A movable stage is a great aid in examining such preparations, for by its use the entire slide may be inspected systematically. In those chronic cases in which it is impossible to demonstrate the gonococci by staining methods, and in which the clinical manifestations point toward a Neisserian infection, or when the medicolegal aspect of the case is involved, cultures should be made. These, because of the difficulty attending the growth of the gonococci on artificial media, are of value only when performed by a skilled bacteriologist.

**Staining Properties of the Gonococcus.**—The gonococci stain readily with any of the anilin dyes. In order satisfactorily to demonstrate the organism, the point to be desired is to stain the gonococci somewhat deeply and the surrounding structures as little as possible, so that the bacteria will stand out prominently. For this reason, whatever stain is selected, care should be taken not to overstain the preparation. For staining film preparations, a great number of methods are in use. Any of the basic anilin dyes, if properly diluted, will give good results. For demonstrating the presence of gonococci in pus, Löffler's<sup>1</sup> solution of methylene-blue is one of the best, for while staining the gonococci deeply, it leaves the cell cytoplasm but faintly colored. Methyl-violet, gentian-violet, Bismarck-brown, safranin,

<sup>1</sup> Löffler and Leistikow: *Charité-Annalen*, Jahrgang 7.

malachite-green, or fuchsin may also be employed. These last are perhaps superior to methylene-blue when the suspected material is free from or contains but little pus. The specimen may be either air dried and fixed by being passed through the flame, or may be air dried and then fixed by placing the films in a solution of equal parts of absolute alcohol and ether for fifteen minutes. The former method is the quickest; the latter gives more beautiful preparations. The following is an excellent simple stain when pus is present in the discharge:

LÖFFLER'S METHYLENE-BLUE SOLUTION FOR STAINING GONOCOCCI

- (a) Spread pus evenly over the cover-glass.
- (b) Air dry.
- (c) Fix either by passing through flame three times or by placing in equal parts of ether and absolute alcohol for fifteen minutes.
- (d) Cover smear with a solution of methylene-blue (saturated 95 per cent. alcoholic solution of methylene-blue, 30 c.c.; to a solution of potassium hydroxid in water, 1:10,000, 100 c.c.) for two minutes.
- (e) Wash in tap-water.
- (f) Dry with buff photo blotting-paper.
- (g) Mount in xylol balsam.

Result: Gonococci stain deep blue; nuclei, a lighter blue; and protoplasm, pale blue.

If speed is desired, the method advocated by Bumm may be adopted. This consists of substituting for the methylene-blue a concentrated watery solution of fuchsin, this stain requiring only thirty seconds. The preparation may be examined without a cover-glass. A 2 per cent. alcoholic solution of methyl-violet solution may also be employed. This is practically a differential stain, and may be used very rapidly. It gives excellent results. Some authorities prefer to examine the suspected secretion by drying it on the slide without fixing. It is then stained and examined while still damp. It is claimed for this method that by it the gonococci are larger and more readily detected. In cases in which difficulty is encountered in demonstrating the gonococci, or for class demonstration, one of the double stains is often of value. These also make beautiful preparations.

Neisser's method of double-staining gonococci is as follows:

NEISSER'S METHOD OF DOUBLE STAINING GONOCOCCI IN SMEAR PREPARATIONS

- (a) Place the fixed specimen in a concentrated alcoholic solution of eosin and heat gently for three minutes.
- (b) Drain off eosin, wash in tap-water, and place immediately in a saturated 95 per cent. solution of methyl-blue for forty-five seconds.

- (c) Wash in tap-water.
- (d) Dry with the aid of buff photo blotting-paper.
- (e) Mount in xylol balsam.

Result: Gonococci and cell nuclei stain blue; protoplasm, a dull red.

F. Abbott recommends the following double stain:

#### ABBOTT'S STAINING METHOD

- (a) Spread, dry, and fix in the usual manner.
- (b) Treat with 20 per cent. solution of tannic acid for one or two minutes.
- (c) Wash in alcohol.
- (d) Dry with filter-paper.
- (e) Stain with Ziehl's solution of fuchsin.
- (f) Decolorize in acid alcohol (acetic acid, 1 part; alcohol, 100 parts; or hydrochloric acid, 1 part; alcohol, 500 parts).
- (g) Dry.
- (h) Stain with methyl-green.
- (i) Wash in water.
- (j) Mount.

Result: Gonococci are dark red; nuclei, purple; protoplasm, light green.

Another double stain is as follows:

- (a) Prepare and fix films in the usual manner.
- (b) Stain for thirty seconds in a freshly made mixture of Löffler's methylene-blue (30 c.c. of saturated alcoholic solution of methylene-blue to which 100 c.c. of 0.01 per cent. of caustic potash (1 c.c. of 1 per cent. caustic potash to 100 c.c. of water) has been added. This solution keeps well), 30 parts, saturated alcoholic solution of eosin, 10 parts.
- (c) Wash and mount in the usual manner.

Result: Bacteria and cell nuclei blue; the remainder, red.

#### PAPPENHEIM'S STAIN

- (a) Prepare, dry, and fix in the usual manner.
- (b) Stain for four minutes in methyl-green, 0.15 gram; pyronin, 0.25 gram; alcohol, 2.5 c.c.; glycerin, 20 c.c.; phenol in water (2 per cent. solution), 100 c.c.

- (c) Wash in water.
- (d) Dry with blotting-paper.
- (e) Mount in the usual manner.

Result: The gonococci are red and the cell nuclei are blue.

A simple method of applying Pappenheim's stain, and one giving almost as reliable results, is as follows:

- (a) Prepare, dry, and fix in the usual manner.
- (b) Stain for one minute in the following solution: To 5 c.c. of distilled



water add methylene-green, about twice as much as can be placed on the end of the blade of a pen-knife, and one-fourth this amount of pyronin (Grübler, Leipzig). This solution should be of a blue-violet color.

(c) Wash in water.

(d) Mount in the usual manner.

Result: Gonococci are red; nuclei, blue.

One of the best of the counterstains is that recommended by Sax,<sup>1</sup> and known as the modified Romanowsky<sup>2</sup> stain. With this method the smears require no previous fixation, as the methyl-alcohol accomplishes this while the staining is going on. For this reason the undiluted stain is first poured on the slide. Then, in order to differentiate, distilled water is added as described below. Two solutions are used, which should be kept in separate well-stoppered bottles. They consist of:

No. 1:

Aqueous eosin ("W. G." Grüber) . . . . . 1 part  
Methyl-alcohol, chemically pure, absolute. . . 100 parts

No. 2:

Methylene-blue (pure, medicinal) (Grüber) . . 1 part  
Methyl-alcohol, chemically pure, absolute. . . 100 parts

Equal parts of No. 1 and of No. 2 are mixed and poured on the slide, where they should be allowed to remain not longer than one minute. Distilled water is then added to the dye until about four times the amount of the original fluid is on the smear. This remains on the slide for five minutes, and is then washed off with distilled water and the slide dried and examined. The resulting smear shows the nuclear material and bacteria blue, and the background salmon colored, with dark-pink cell-bodies. Or the following method may be employed:

#### ROMANOWSKY'S STAIN (LEISHMAN'S MODIFICATION)

Dissolve one "Soloid" product of Romanowsky's stain (Leishman's powder), 0.015 gram, in 10 c.c. of pure methyl-alcohol. Allow this solution to stand for about three or four hours before using. Spread pus evenly over the cover-glass and allow same to dry in the air. Without fixing the specimen drop enough of the prepared stain on it completely to cover the smear. Allow the stain to act for from fifteen to thirty seconds, and then add as many drops of distilled water as were used of the stain. The diluted stain should remain on

<sup>1</sup> Sax: Trans. Amer. Urol. Assoc., 1909, Brookline, 1910, vol. iii, p. 131.

<sup>2</sup> Romanowsky, D.: St. Petersburg. med. Wochenschr., 1891, No. 34, p. 297.



the slide for from five to ten minutes, after which time it is washed off with tap-water and the slide dried with blotting-paper. Mount in xylol balsam.

Result: Cocci stain blue; nuclei of leukocytes, rose-red; eosinophile granules, red; protoplasm of mononuclear and coarsely grained eosinophile cells, light blue.

McKee<sup>1</sup> recommends that the films be prepared after the method used in trachoma cases. The material is spread on the slide, dried in the air, fixed for ten minutes in 80 per cent. alcohol, stained with Giemsa's solution, 1, to 20 parts of distilled water, for twenty minutes. Or Giemsa's new method may be employed. This is as follows: Dry the film in the air, fix in 80 per cent. alcohol for ten minutes, place film in a Petri dish, and cover with staining fluid consisting of equal parts of Giemsa stain and pure methyl-alcohol. Stain thus for thirty seconds, then add 10 or 15 c.c. of distilled water, and agitate until the mixture becomes homogeneous. In three minutes remove and proceed to mount the specimen in the ordinary manner. McKee states that by either of these stains gonococci may be demonstrated in epithelium when ordinary methods fail.

#### LESZCZYNSKY'S STAIN<sup>2</sup>

The smear is prepared and fixed in the usual way.

Stain for one or two minutes or until smear is deep blue, in the following mixture:

Saturated watery solution of thionin-blue	10.0
Phenol (pure) . . . . .	2.0
Distilled water . . . . .	88.0

Wash in distilled water and stain for forty-five seconds to one minute, or until a clear yellow, in:

Saturated watery solution of picric acid . . . . .	} equal parts
Solution of potassium hydroxid (0.1 per cent.) . . . . .	

Wash with distilled water, dry with blotting-paper, immerse in absolute alcohol for five seconds, wash again with distilled water, dry with blotting-paper, and mount in xylol balsam.

Result: Intracellular but not extracellular cocci stain black.

#### KNAACK'S METHOD OF STAINING GONOCOCCI IN SMEAR PREPARATIONS

(a) Prepare in ordinary manner, air dry, and fix.

(b) Stain in a saturated 95 per cent. alcoholic solution of methylene-blue for three minutes.

(c) Wash in tap-water and dry with buff photo blotting-paper.

<sup>1</sup> McKee, H.: The Ophthalmic Record, January, 1912, p. 1.

<sup>2</sup> Pollock, C. E., and Harrison, L. W.: Gonococcal Infections. London, 1912, p. 216.

(d) Place in a 1 per cent. solution of argonin and distilled water for four minutes.

(e) Wash in distilled water.

(f) Place in a watery solution of fuchsin (saturated) for ten seconds.

(g) Wash in tap-water, dry with blotting-paper, and mount in xylol balsam.

Result: Gonococci stain blue; protoplasm, pale pink; nuclei, purple.

#### LANZ'S STAIN<sup>1</sup>

Saturated solution of thionin-blue in 2 per cent.

phenol.....4.0 parts; to

Saturated solution of fuchsin in 2 per cent. phenol....1.0 part

Mix solution immediately before use and allow the stain to act for from fifteen to thirty seconds, wash in distilled water, dry with blotting-paper, and mount in xylol balsam.

Result: Cocci stain blue; nuclei of cells, bluish red; and their protoplasm, light red.

#### METHYL-GREEN-PYRONIN STAIN (UNNA-PAPPENHEIM) FOR GONOCOCCI IN TISSUES

Methyl-green (00 crystals (Grübler)).....0.15 gram

Pyronin.....0.50 "

96 per cent. alcohol.....5.00 c.c.

Glycerin.....20.00 "

Warm the solution and stain the sections for four or five minutes in the incubator; wash in cold distilled water. Dehydrate quickly in absolute alcohol, clear in xylol, and mount in xylol balsam.

Result: Gonococci stain red; cell nuclei, blue.

Staining by the foregoing methods, while it brings out the gonococci, also colors other organisms. Only rarely are other bacteria morphologically similar to the gonococci present in the male urethra. The same cannot be said for the female genital tract, which, especially in the multipara, literally swarms with organisms, some of which, stained by the methods just described, are indistinguishable from the gonococcus.

It is to Dr. Gabriel Roux,<sup>2</sup> of Paris, that we are indebted for the discovery of a means that practically differentiates, by a rapid staining method, the gonococcus from all other morphologically similar organisms found in the genital tract. The method referred to is the staining of suspected material by Gram's solution. In 1886 Roux published his conclusions. His findings were confirmed in the following year by Allen<sup>3</sup> and Wendt,<sup>4</sup> of New York, whose papers, although

<sup>1</sup> Pollock, C. E., and Harrison, L. W.: *Gonococcal Infections*, London, 1912, p. 216.

<sup>2</sup> Roux, G.: *Le Concours Médical*, November 13, 1886; also *Report Acad. des Scien.*, Paris, November 8, 1886.

<sup>3</sup> Allen, C. W.: *Jour. Cutan. and Genito-urin. Dis.*, N. Y., 1887, vol. v, p. 81.

<sup>4</sup> Wendt, C. E.: *Med. News*, Phila., 1887, vol. l, p. 455.

appearing separately, are practically identical in so far as results are concerned.

Gonococci are decolorized by Gram's stain, and in this they differ from the majority of other bacteria found in the genitalia, with which they are likely to be confused.

In cases in which the diagnosis is of great importance, or to secure medicolegal evidence, this method is not sufficient, and cultures must be resorted to. Gram's method is also uncertain when "clap shreds" are present. In chronic cases gonococci may occasionally stain irregularly by Gram's method, or be themselves atypical in shape. Gram's method of staining is as follows:

#### GRAM'S STAINING METHOD

(a) Prepare, dry, and fix the secretion in the usual manner.

(b) Stain in anilin-water-gentian-violet or anilin-water-methyl-blue for at least two minutes. (This solution may be made as follows: Place sufficient anilin water in a test-tube to cover the bottom. Then fill the tube three-fourths full with distilled water. Shake well. After shaking, undissolved oil should be present. Filter through moist filter-paper. The filtrate must be clear. If any oil-droplets have passed through, refilter. To this clear solution of anilin oil add a saturated solution of gentian-violet or methyl-violet until a shining film appears on the surface, or as much dye as will dissolve may be added. The staining properties of this mixture may be increased by adding 1 c.c. of a 1 per cent. solution of sodium hydroxid to 100 c.c. of the mixture. These stains do not keep well, nor does anilin-water, and therefore should be freshly prepared.)

(c) Wash in anilin-water.

(d) Stain in Gram's solution for from thirty seconds to two minutes, according to the thickness of the film, etc. (Gram's solution consists of 1 part of iodine; 2 parts of potassium iodide, and 300 parts of distilled water. It is best to dissolve the iodine and potassium iodide in 5 parts of water and then add this to the remaining 295 parts of water.)

(e) Decolorize the preparation in absolute alcohol until no more color is given off. (It is best to use two or three alcohols.) At this stage Gram's positive bacteria are stained blue black, while Gram's negative organisms are unstained. The cover-glass, therefore, can now be examined in water or may be dried and mounted in balsam or may be—

(f) Counterstained with a watery solution of fuchsin, thirty seconds to one minute, and then—

(g) Washed in water.

(h) Mounted in the usual manner.

Gram's method may also be applied as follows: To 10 c.c. of distilled water add 2 c.c. of anilin oil. Shake, and filter through moist

filter-paper to remove oil-globules. To the clear filtrate add 1 c.c. of 98 per cent. alcohol and a like amount of a concentrated alcoholic gentian-violet solution. After fixing the suspected secretion by passing it through the flame in the usual manner it is covered with this solution for from two to three minutes. Drain off excess of stain with filter-paper (do not wash in alcohol). The cover-glass is now placed in Gram's solution for five minutes, and thence transferred to absolute alcohol to decolorize. This should be continued until the drainings fail to stain the filter-paper. After the alcohol the preparation is washed in water and placed in a solution of Bismarck brown, 1 part, and water, 5 parts. In this it is allowed to remain for one or two minutes, or for forty-five seconds in a saturated aqueous solution of Bismarck brown diluted with three times its volume of water. It is then washed in water and mounted in the usual way. The gonococci, having been decolorized by the Gram stain, are now brown.

#### GRAM'S METHOD FOR SECTIONS

(a) Stain with anilin-water-gentian-violet or anilin-water-methyl-blue or from ten to twenty-five minutes.

(b) Wash in anilin-water thirty seconds.

(c) Transfer to Gram's solution for one to two minutes. (Sections now become brown.)

(d) Wash in absolute alcohol until section appears nearly or entirely unstained. The purple color of the gentian-violet changes to dirty yellowish brown, and the section resembles tea-leaves. Section must become brown. In the alcohol the purple color of the gentian-violet returns and is dissolved out, so that if the manipulations have been properly performed, the films at this stage are practically colorless. The decoloration may be hastened by moving the section gently about in the alcohol. Two or three baths are usually required—a fresh one as soon as the first becomes discolored. If drop glasses are used for decolorizing, it is important to remember the side of the slide on which the section is, for this is somewhat difficult to determine after decolorization has taken place. At this stage the section may be cleared in cedar oil and mounted; Gram's positive organisms are blue black, and Gram's negative bacteria are unstained, or the section may be counterstained to bring out the tissue and micrococci that are not stained by Gram's solution.

(e) For counterstaining, wash in water and immerse in a solution of dilute fuchsin for from five to ten minutes. If desired, a solution of eosin may be substituted for the fuchsin for fifteen or thirty seconds.

(f) Wash in 60 per cent alcohol.

(g) Dehydrate in absolute alcohol.

(h) Clear in cedar oil or xylol and mount.

Result: All the Gram-positive bacteria are stained blue black; the tissue, red; the cell nuclei, pale blue or even dark blue. Bacteria are frequently not

stained equally well in all parts of the section, and this is particularly likely to be so if the section is a large one or thicker than 5  $\mu$ .

Gram's method, modified as follows, has the advantage that the stain in the preparation keeps much better. Instead of making up the stain with anilin-water, a 0.5 per cent. solution of carbol-water is substituted. After staining, the preparation should be washed in carbol-water of a corresponding strength. The addition of one-tenth part of a solution of methylene-blue is recommended for decolorizing. For decolorizing quickly Gunther prefers absolute alcohol to which is added sufficient hydrochloric acid to make the entire solution 3 per cent. This is followed by absolute alcohol alone. Nicolle recommends carbol-water gentian-violet, made with 1 per cent. carbol-water and iodid solution as follows: One part of the iodid, 2 parts of potassium iodid, plus 200 parts of water. For decolorizing, he employs an alcoholic solution of acetone.

When decolorizing, after using Gram's stain special care must be taken, for if left in alcohol too long, even the Gram-positive micrococci will be decolorized, whereas if the preparation be left in too short a time, Gram's negative bacteria will retain some of the stain. For this reason, when possible, it is advisable to place on one corner of the cover-glass holding the material about to be examined a small quantity of a culture from some known Gram-positive organism, and on another corner a few anthrax or other Gram-negative micrococci. In this way control strains may be easily and certainly obtained. It is also an excellent plan to have at hand some gonococci of undoubted authenticity, to compare with doubtful specimens. These slides should be stained in the same manner as the slides containing the material for diagnosis. Weinrich<sup>1</sup> rejects practically all modifications of Gram's stain, and warns especially against the use of acetone-alcohol (Nicolle's method), and still more against the use of acid alcohol for decolorizing gonococci, these methods having a tendency to decolorize Gram-positive diplococci. Van Derbergh<sup>2</sup> and Paltrock<sup>3</sup> recommend absolute alcohol for decolorizing, but apply it for not more than thirty seconds, and never "until no more violet comes off."

Keyes<sup>4</sup> stains the films for three minutes in a solution consisting of anilin oil, 3 parts; absolute alcohol, 7 parts; distilled water, 90 parts; these are shaken well together and filtered through moist filter-paper

<sup>1</sup> Weinrich, M.: *Cent. f. Bakt., etc., Abt.*, Jena, 1898, vol. xxiv, pp. 258-265; also *Ann. d. mal. d. org. genito-urin.*, Paris, 1898, vol. xvi, p. 504.

<sup>2</sup> Van Derbergh: *Cent. f. Bakt.*, vol. xx.

<sup>3</sup> Paltrock: *Der Gonokokkus Neisseri*, Dorpat, 1907, p. 98.

<sup>4</sup> Keyes, E. L.: *Diseases of the Genito-urinary Organs*, 1911, pp. 98-100.

until the filtrate is clear; it is then stored for twenty-four hours and the supernatant fluid is pipeted off as required. After staining a number of slides in this solution one is washed off in water and examined. If organisms morphologically similar to the gonococcus are discovered, other slides that have not been in water are placed in Lugol's solution (iodin, 1 part; potassium iodid, 2 parts; distilled water, 300 parts) for two minutes. They are then transferred to absolute alcohol for exactly thirty seconds, and are afterward counter-stained with a solution of Bismarck brown, 98 parts, and phenol, 2 parts.

According to Neisser,<sup>1</sup> the period required for decolorization by Gram's stain is dependent upon the medium in which the gonococcus is found. Thus it is said that gonococci in pure culture will decolorize in from fifteen to twenty seconds, in about twenty to thirty seconds when in pus, and in one minute when in mucus. The thickness of the film is also an important factor. Occasionally artificially grown gonococci retain the stain for a long time. In selecting material from cultures for staining purposes preference should be given to young colonies.

**Demonstration of Gonococcus in Dried Secretion.**—The identification of the gonococcus in dried secretion, either on linen or on clothing, is under certain conditions possible even after prolonged periods. This point is sometimes of medicolegal importance. The author agrees with Ledermann,<sup>2</sup> who states that although it is possible to show gonococci from the clothing even after months or years, such demonstration, for forensic purposes, should be received with extreme caution. The presence of gonococci is proved only when the bacteria are found in characteristic grouping, in leukocytes, when there is a chance for counterstaining with Gram's method, and when the organisms under suspicion correspond morphologically to the gonococcus. When in dried secretion, culture methods fail almost regularly, as the gonococcus is killed by prolonged drying. The difficulty of positively identifying the gonococcus in dried pus can be readily understood. Wachholz and Nowak<sup>3</sup> found micrococci in a spot of dried secretion on the skirt of a girl who had been repeatedly ravished. Their supposition that the pus was from a gonorrhea was contradicted by the fact that neither the girl nor the malefactor had gonorrhea. Ledermann,<sup>4</sup> however, believes that these authors go too far when they state that cultures are the only certain method by which gonococci can be positively identified. At the Second International Medical Congress

<sup>1</sup> Neisser, A.: In *Kolle u. Wassermann, Handbuch f. Bakt.*, 1903, vol. iii.

<sup>2</sup> Ledermann, R.: *Amer. Jour. Dermat.*, November, 1910, vol. xiv, No. 11, p. 51.

<sup>3</sup> Wachholz and Nowak: *Vierteljahressch. f. ger. Med.*, 1895, No. 9; also Schmidt-mann's *Handbuch f. gerichtliche Medizin*.

<sup>4</sup> Ledermann: *Loc. cit.*

in Berlin, in 1890, Kratter reported having demonstrated gonococci in dried secretion by the following method: The dried secretion was scraped from the linen and soaked for a short time in water, or the threads with the adherent remnants of the discharge were macerated and squeezed out. The gonococci were then stained by the usual method. Haberd<sup>1</sup> experimented with this method. When he allowed a very thin layer of pus containing gonococci to dry on clothing, he could show the microorganism only after a few weeks. In thick layers, of which minute particles could be gained, gonococci were in evidence after eight months. But the characteristic marks had disappeared, and the differential diagnosis from other diplococci could not be made with certainty. Even worse were his results when he investigated material from chronic gonorrheas or when dirty linen was used.

Heger-Gilbert<sup>2</sup> employed the following method with better success: A small linen pad or piece of blotting-paper moistened with isotonic salt solution (0.9 sodium hydroxid in 100 parts of water) and rendered alkaline by the addition of sodium bicarbonate is placed in a watch-glass. The suspected piece of linen is cut out and laid on the pad and covered. After from one to five hours, according to the age, thickness, and dryness of the specimen, the droplets that collect underneath are obtained with a suction pipet and placed upon a slide, dried, and stained. By this method Heger-Gilbert was able to demonstrate gonococci in secretion that had been dried for two years.

**Examination of the Urine for Gonococci.**—In dealing with hypersensitive women, or for other reasons, it may be necessary to attempt to demonstrate gonococci in the urine. If this is the case, a morning specimen of urine should be obtained, the patient having been instructed to milk out the urethra with the finger while urinating. The urine should be allowed to stand for a short time in a conic urine glass. The sediment should then be centrifugalized at a high rate of speed (1200 involutions a minute) for three minutes, and large films of the pus and epithelial debris thus collected may be stained in the manner previously described. If a large amount of material is obtained at the first centrifugation, this may be mixed with normal salt solution and again centrifuged, under which circumstances the demonstration of the organism is somewhat facilitated. "Clap shreds" should also be examined. Some pathologists object to the use of the centrifuge because the molecular agitation tends to break up and destroy the leukocytes and epithelial cells, and thus make the intracellular demon-

<sup>1</sup> Haberd: Quoted by Ledermann: *Loc. cit.*

<sup>2</sup> Heger-Gilbert: Soc. Roy. des Sciences Méd. et Naturelles de Bruxelles, June 1, 1908.



stration of the gonococcus more difficult. Such authorities recommend collecting the sediment in a conic urine glass after the specimen has stood for a few hours. The objection to the use of the centrifuge is more theoretic than practical. Fresh urine should be employed for cultures. Urine that has been passed for some hours is useless. It must be borne in mind that gonococci degenerate quickly in urine, and for this reason atypical forms may be present unless the urine is fresh.

Attempts to demonstrate gonococci in the urine of women are usually unsatisfactory, and can be viewed only as makeshifts until a more thorough examination can be performed. Little or no reliance can be placed on negative findings.

Although, as has been stated elsewhere, the staining characteristics previously described are not absolutely diagnostic of the gonococcus, they are, if properly carried out and if viewed in conjunction with the clinical symptoms, sufficiently exact for all practicable purposes. The decolorization by Gram's method is certainly the most characteristic staining properly possessed by the gonococcus, and is a test that should never be omitted in differentiating this microorganism from others morphologically similar. In examining secretion from the female genital tract gonococci may be so few in number and other microorganisms so numerous that the diagnosis is extremely difficult. If this is the case, a large number of films should be prepared and stained.

The following microorganisms are Gram positive: The streptococcus, the staphylococcus, and the pyogenic cocci in general, yeasts, molds, the pneumococcus of Fränkel, the *Micrococcus tetragenus*, anthrax, tetanus, and tubercle bacilli, the bacteria of leprosy, diphtheria, swine erysipelas, and mouse septicemia, the potato bacillus, and some others.

The following are Gram negative: The gonococcus, the *Micrococcus melitensis*, the *Micrococcus catarrhalis* (Pfeiffer), the typhoid bacillus, the *Bacillus coli* and similar bacteria, cholera and similar vibrios, the bacillus of fowl cholera, rabbit septicemia and malignant edema (the last is said occasionally to remain Gram positive), Friedländer's plague bacillus, the glanders bacillus, the bacillus of influenza, the spirillum of relapsing fever, and the meningococcus.

All the bacteria in the first list may be excluded by the proper application of the Gram stain. Of the second list, the *Micrococcus meningitidis* and the *Micrococcus catarrhalis* are morphologically very similar to the gonococcus, and as they are both decolorized by Gram's stain, they cannot be excluded by this method. The *Micrococcus*



catarrhalis is slightly larger than the gonococcus, but, owing to the variability in size of the latter, little significance can be attached to this feature.

The *Micrococcus citreus conglomerata* (Bumm<sup>1</sup>), the *Diplococcus albicans amplius* (Bumm<sup>1</sup>), the *Diplococcus albicans tardissimus* (Bumm<sup>1</sup>), and the *Micrococcus subflavus* (Bumm<sup>1</sup>), are all morphologically somewhat similar to the gonococcus, but can be excluded by Gram's method. Another group of bacteria usually found in the sputum and nasopharynx, and which are saprophytic, catarrhal-like organisms, sometimes cause confusion. These have been described by Elser and Huntton, who term them the chromogenic Gram-negative cocci. Lingelsheim has studied these organisms carefully and gives the following list:

*Micrococcus pharyngeus sicca* (Lingelsheim), *Micrococcus pharyngeus cinereus* (Lingelsheim), *Diplococcus pharyngeus flavus I* (Lingelsheim), *Diplococcus pharyngeus flavus II* (Lingelsheim), and the *Diplococcus pharyngeus flavus III* (Lingelsheim), are micrococci that differ from the *Micrococcus catarrhalis* only in the amount of yellow pigment they contain.

Fortunately, none of the organisms making up this rather formidable list of Gram-negative bacteria is often found in the genital tract, and this is especially the case in the male. Nevertheless, when a positive diagnosis is required, either for sociologic or for medicolegal purposes, other means than staining have to be resorted to. For these cases cultures offer a method of absolute certainty in diagnosis.

To Bumm's<sup>1</sup> indefatigable labors during the period of the early history of the gonococcus are we indebted for much of our knowledge regarding the growth of this microorganism on artificial media. It may be stated, at the outset, that the cultivation of the gonococcus in the laboratory is a somewhat difficult procedure, and should not be attempted without special technical bacteriologic training. The attempted diagnosis of gonorrhea by culture methods, unless performed by a skilled bacteriologist, is useless.

**Biology.**—The gonococcus grows best at blood temperature, the extreme limits being 25° to 40° C. The optimum temperature is 35° to 37° C. Unfortunately, when within the human system gonococci are more resistant to variations in temperature. Attempts to cure anterior urethritis of gonorrheal origin by means of dry heat or the application of cold have not met with much success, although cold is undoubtedly a valuable adjunct to the treatment of specific ophthal-

<sup>1</sup> Bumm, E.: *Der Mikro-organismus gonorrhöischen Schleimhaut-Erkrankungen*, Wiesbaden, 1885.

mia, but probably in this location acts as much by relieving congestion as by actually inhibiting the growth or attenuating the microörganism. The atmosphere should be somewhat moist. The organism is aërobie, and possibly slightly facultative anaërobie, but it does not grow along the line of puncture when stick cultures are made in blood-serum. It does not produce spores, and is strictly parasitic, its habitation being the human body. The gonococcus is often associated with other organisms.

**Resistance.**—When left at room temperature, cultures die in two or three days. When placed in the ice-box, they may live for several weeks, but usually perish moderately quickly. Gonococci are, however, markedly more resistant to cold than are cultures of the meningococcus, which are always killed by temperatures approximating 0° C. Gonococci have but little resistance against outside influences, and are easily destroyed by weak antiseptic solutions, especially those that contain silver salts, as shown by the work of Schaeffer and Steinschneider.<sup>1</sup> Gonococci in pus, when smeared on linen in thick layers, has been known to live for forty-nine days and twenty-nine days when dried on a cover-glass. Complete desiccation, however, kills in a short time. According to Heiman,<sup>2</sup> incompletely dried and protected from the light, as in the case of pus, the gonococci may live in sheets or clothing for a considerable period of time. It is killed in six hours by a temperature of 45° C., and in thirty minutes by a temperature of 60° C. At the latter temperature its virulence is destroyed in ten minutes. Individual strains of gonococci exhibit marked variations in respect to their resistant properties.

**Culture-media.**—The gonococcus grows sparingly on artificial media, and requires for its best development the addition, to nutrient agar, of a small amount of blood-serum or its equivalent, human serum being somewhat better than that obtained from the lower animals. After having been subcultured a few times, the amount of serum may be reduced, and, indeed, with some strains may occasionally eventually be almost entirely eliminated. The native protein is essential for the development of the gonococcus. The soil should be feebly alkaline or acid. For successful growth cultures require to be frequently transplanted. This is especially important at first. After living in subcultures for a few months the periods of subculturing may be gradually lengthened. Some strains under such circumstances survive for periods of three or even six weeks, provided the proper moisture and temperature are maintained.

<sup>1</sup> Schaeffer and Steinschneider: Kong. Deut. Dermat. Gesell., Breslau, 1894.

<sup>2</sup> Heiman: Studies from Path. Lab., College of Phys. and Surg., New York, 1895, p. 3.

The great number of culture-media recommended by various authorities shows the lack of an ideal medium. Thalmann obtained primary cultures (subcultures failed) on his agar. Wildbolz<sup>1</sup> succeeded in maintaining a growth on agar after several subcultures on serum-agar. Vannon<sup>2</sup> and later Martin<sup>3</sup> isolated and maintained a number of strains of gonococci on plain agar. When gonococci are successfully cultivated in serum-free media, the success has probably been due to material carried over when making the culture. Subcultures usually fail. For successful cultivation of the gonococcus the consensus of opinion is that a preparation of uncoagulated albumin, derived from either man or animals, is an essential constituent of the medium. Neither hemoglobin nor urine is of especial service. Martin<sup>4</sup> has pointed out that a medium most rich in albumin is not necessarily the best, whereas small amounts of human serum markedly accelerate growth; large proportions have a decided bactericidal action on gonococci. When making cultures, surface inoculations are usually the most successful, as gonococci grow best in the presence of free oxygen. The culture material must be moderately moist, and for this reason many authorities recommend capping the tubes or Petri dishes with rubber sheeting during incubation. Below follow the details of the method of preparation of a few media that have given good results:

*Bumm's Solidified Human Blood-serum (Abel<sup>5</sup>).—*During the course of a normal delivery, when the cord has been ligated as usual with two ligatures and severed between these, the placental end is disinfected and cut through above the proximal ligature. The blood that exudes is collected in a sterile flask. This vessel is allowed to stand for twenty-four hours in a cool place. With a sterile pipet the separated, clear or slightly blood-stained serum is then removed and filtered into sterile test-tubes. The separation of the serum can be facilitated by loosening the blood-clot from the sides of the vessel with a sterile glass rod a few hours after the blood has been collected. The serum may be converted into a transparent solid medium by heating for a variable time at about 70° C., the test-tubes being slanted in the special apparatus designed for this purpose. Although every effort may have been made, this serum is frequently not sterile. For this

<sup>1</sup> Wildbolz, H.: Arch. f. Dermat. u. Syph., Vienna and Leipzig, 1903, vol. lxiv, pp. 225-264.

<sup>2</sup> Vannon: Cent. f. Bakt. u. Parasitenk., vol. xl, p. 162; *ibid.*, 1907, Abt. 1, orig. vol. xlv, p. 10.

<sup>3</sup> Martin, W. B.: Jour. Path. and Bact., July, 1910, p. 76.

<sup>4</sup> Martin, W. B.: *Loc. cit.*

<sup>5</sup> Abel, R.: Laboratory Handbook of Bacteriology, translated from the tenth edition by M. H. Gordon, London, 1907.

reason it should be sterilized by the fractional method and then, to make sure, the tubes should be placed in the incubator for twenty-four hours and those eliminated in which growth takes place.

Another method is to pour the serum into medicine bottles. To these add plenty of chloroform. Park recommends using 5 per cent.; chloroform, being volatile, tends to disappear at ordinary temperatures, but is quickly and surely driven off at the temperatures used in sterilizing. Close the bottles with rubber stoppers. Store for several months, at the expiration of which time the serum is positively germ free. The chief disadvantage of this method is the time required. Sterilization by filtration is a tedious and unsatisfactory method. For most purposes the transparency of the serum may be sacrificed, for this is, as a rule, of no great value. Sterilize after solidification in slanting tubes by heating to 95° or 98° C., for one-half hour for three successive days, or the material may be heated to 100° C. at once. If the latter is done, the surface of the medium often becomes uneven, from the formation of bubbles. In whatever way prepared, the media should be tested in the incubator at 37° C. for twenty-four hours, and all test-tubes that show contamination eliminated. If it is desired, the medium may be allowed to solidify in Petri dishes and sterilized as just described. This has the disadvantage that the surface of the media dries quickly and extraneous organisms tend to find access to it. Ascitic or hydrocele fluid, obtained by aseptic puncture, can be used in place of the serum. The reaction is, however, sometimes very alkaline and should be tested. Should the placenta have been expelled, it may be subjected to manual pressure and the blood obtained in this way. On this media, when solidified, cultures are made. The growth is not luxuriant.

*Wertheim Human Blood-serum and Agar Mixture (Abel<sup>1</sup>).*—Each of three sterile test-tubes receives 1 c.c. of fluid serum (obtained as just described), and all are then warmed to 40° C. The first tube is inoculated with gonococci; from it, the second; and from that, the third. Two c.c. of melted agar at a temperature of about 40° C. are then passed into each tube, and the mixture poured out at once into Petri dishes and allowed to solidify. Additional suspected material should be smeared over the surface of the solidified plates. It is then incubated. The colonies are larger than on the preceding medium. This is one of the best media. Some authorities believe that Wertheim's<sup>2</sup> medium is improved by the addition of 6 per cent. glycerin or 1 per cent. glucose.

<sup>1</sup> Abel: *Loc. cit.*

<sup>2</sup> Wertheim: *Arch. f. Dermat. u. Syph.*, 1899, vol. xli, No. 1.

*Keifer's Ascitic Agar* (Abel<sup>1</sup>).—Neutral meat-extract agar, containing 3.5 per cent. agar, 5 per cent. peptone, 2 per cent. glycerin, and 0.5 per cent. sodium chlorid, is melted, and when it has cooled to 50° C., is mixed with an equal quantity of ascitic fluid (obtained under aseptic conditions), and allowed to solidify either in Petri dishes or in slanted tubes. The same precautions regarding sterility as are recommended for Bumm's<sup>2</sup> medium should be carried out. Surface cultures are made on this medium. If the ascitic fluid is strongly alkaline, it should be mixed with unneutralized or strongly acidified agar solution, so that the mixture will be rendered slightly alkaline. Meyer<sup>3</sup> employed this medium in 90 cases, and was able to cultivate the gonococci in 87 cases; in only 58 of these cases was it possible to demonstrate the microorganism in the secretion by means of the microscope.

*Abel's<sup>4</sup> Blood-smeared Agar*.—The finger or some other portion of the skin is disinfected and then washed in sterile water to rid it of the antiseptics. A puncture is then made, and the blood thus obtained is smeared on the surface of nutrient agar. The test-tubes should be stoppered with sterile cotton. Surface cultures are made by taking a small quantity of the suspected secretion on the end of a sterile camel's-hair brush and rubbing this up with a drop of sterile blood. The mixture on the brush is then smeared over the surface of the medium after having first made sure of the sterility of the latter. This medium is recommended for subcultures chiefly because it is easy to prepare. The first generation does not always grow upon it. Cole and Meakins have had excellent results with this medium.

*Wright's Modification of Steinschneider's Method*.<sup>5</sup>—The details of the method as given by Wright are as follows: "A liter of nutrient agar is prepared in the usual manner, and after filtration it is evaporated to about 600 c.c. This concentration is desirable, so that after dilution with the urine and serum the medium may be sufficiently firm. This concentrated agar is then run into test-tubes, and the whole sterilized by steam on three successive days. The quantity of agar placed in each tube is smaller than is usual; this is in order to allow for the subsequent addition of the urine and serum.

"The blood-serum, which need not be free from corpuscles, is first passed through white sand, which is supported in a funnel by filter-paper, in order to remove, as far as possible, any particles in suspension, and is then mixed with half its volume of fresh urine. The mix-

<sup>1</sup> Abel: *Loc. cit.*

<sup>2</sup> Bumm, E.: *Der Mikro-organismus gonorrhöischen Schleimhaut-Erkrankungen*, Wiesbaden, 1885.

<sup>3</sup> Meyer: *Deutsch. med. Woch.*, 1903, vol. xxix, No. 36.

<sup>4</sup> Abel: *Loc. cit.*

<sup>5</sup> Wright: Quoted by A. C. Abbott: *Principles of Bacteriology*, eighth edition, 1909, p. 290.

ture of urine and blood-serum is next filtered by suction through an unglazed porcelain cylinder into a receiving-flask, such as chemists use for similar purposes, by means of a water-vacuum pump. This frees the mixture from bacteria.

"The usual precautions are, of course, taken to prevent the contamination of the filtrate, such as the previous sterilization by steam of the cylinder and receiving-flask, besides others which will occur to any bacteriologist.

"To the agar in each test-tube, which is fluid and of a temperature of about 40° C., there is added about one-third to one-half its volume of the filtered mixture of urine and blood-serum. This is conveniently accomplished by pouring the mixture from the receiving-flask through the lateral tube, inserted near its neck directly into the tubes. The preliminary melting of the agar is best effected in the steam sterilizer, in order that any organisms which have found lodgment in the cotton plugs of the tubes may be destroyed. When the agar is melted, it is cooled and kept fluid by placing the tubes in a water-bath at 40° C. Each tube, after the addition of the urine and serum to the fluid agar, is quickly shaken to insure a uniform mixture, and is then placed in an inclined position to allow the agar to solidify with a slanting surface. When the medium in the tubes has solidified, the tubes are placed in the incubator for about twenty-four hours to test for contaminations, after which they are ready for use."

*Naka-Abe Serum Medium.*—This serum is made by macerating 500 grams of beef with 1 liter of water for twenty-four hours in the ice-chest. This is then filtered through a Chamberland filter. The fluid is flaked and kept for four weeks, during which time its bactericidal portions are destroyed. It is then added to plain agar, in the proportion of 1 to 2. The originator claims excellent results for this medium, and asserts that the growth is always visible in eighteen hours.

*Wassermann's<sup>1</sup> Nutrose Medium.*—Mix in a flask 15 c.c. of swine's blood, 30 to 40 c.c. of water, 2 to 3 c.c. of glycerin, 0.8 gram of nutrose, and, while constantly shaking the mixture, boil for fifteen minutes. Repeat boiling and shaking on following day. This fluid may now be stored. Before using, heat to 50° to 60° C., and mix with an equal quantity of sterile 2 per cent. peptone-agar. This medium is excellent for surface subcultures.

*Thalmann's Meat-extract Agar (Abel<sup>2</sup>).*—Prepare meat extract as follows: Take 500 grams of finely chopped beef, as free from fat as possible, warm in a pot with one liter of water to 50° C., at which tem-

<sup>1</sup> Wassermann; Zeit. f. Hygiene, 1897, vol. xxvii; also Berlin. klin. Woch., 1897, No. 32.

<sup>2</sup> Abel; Loc. cit.



perature it should be kept for thirty minutes. Then boil for from one-half to three-fourths of an hour. Strain off the fluid from the meat. Add enough water to make one liter and then run into a flask, the mouth of which should then be stoppered with cotton. If this is to be preserved, it should now be sterilized by the fractional method, or by exposing it in an autoclave to a temperature of 100° C. for fifteen minutes. To this solution add 1.5 to 2 per cent. of finely chopped agar. Two hours later, when the agar has become softened, add 0.5 to 5 per cent. of common salt. Heat gently in a steamer until agar is dissolved. Nearly neutralize with phenolphthalein. The acidity of the mixture must usually be reduced about two-thirds to three-fourths by the addition of caustic soda. The method of neutralization with phenolphthalein is as follows: Place 5 c.c. of the medium in a flask, dilute with 45 c.c. of freshly prepared distilled water, and boil for three minutes over a flame. Now add 1 c.c. of phenolphthalein (0.5 gram phenolphthalein in 100 c.c. of 50 per cent. alcohol) and titrate with hydrochloric acid until the fluid develops a red color. Add to the remainder of the medium, according to the result of this titration, experimental normal sodium hydroxid or normal hydrochloric acid until the reaction is neutral. Then titrate again a sample of the medium (5 c.c.) as directed above, and correct the reaction of the remainder, if necessary. Heat to boiling and test again. If the medium is now neutral or slightly alkaline to phenolphthalein, it is strongly alkaline to litmus, since the peptone or diphosphate present in the medium is neutral or alkaline to litmus, but acid or neutral to phenolphthalein. As media are more suitable for bacterial growth when neutral or slightly alkaline to litmus, media neutral to phenolphthalein must receive an addition of acid. Thus from 1.5 to 2.5 per cent. of hydrochloric acid (note how much) is added, and the mixture boiled, filtered, and sterilized. For subcultures Thalmann recommends broth of similar reaction, or a serum may be made by mixing such broth with sterile serum in equal parts and allowing it to solidify.

*Lipschütz's<sup>1</sup> Egg-albumen Agar Culture-medium.*—To 3 parts ordinary peptone agar or broth add one part alkaline 2 per cent. egg-albumen solution. Merck's finely powdered egg-albumen is recommended by Lipschütz. This is readily soluble in water. The albumin solution may be filtered and sterilized before adding the agar to it. This medium is easily made, and the albumin can be obtained without difficulty. The originator of the method states that he has grown gonococci in this medium to the thirty-fifth generation.

<sup>1</sup> Lipschütz: Cent. f. Bakteriologie, 1904, vol. xxxvi.

*Baer's*<sup>1</sup> *Medium*.—Baer recommends the following medium: Hydrocele, pleuritic, or ascitic fluid is collected under aseptic conditions in sterile flasks. This is placed in test-tubes and tested for sterility in the incubator for twenty-four hours at 37° C. All tubes that exhibit growth are discarded. The sterile transudate is then mixed with plain agar that has been previously condensed to two-thirds of its bulk, in the proportion of one part of transudate to two parts of agar. The transudate is added to the agar in test-tubes, the agar having been melted and cooled to 45° C. The tubes thus prepared are capped with sterile rubber and allowed to solidify in a slanting position. The medium is then tested for sterility in an incubator at 37° C. for two days. This medium is used for surface cultures. The condensed water in the tubes assists in spreading the suspected secretion over the surface.

*Bowhill's*<sup>2</sup> *Medium*.—A good liquid medium, recommended by Bowhill, may be prepared by mixing 1 part of human blood-serum with 2 parts of peptone bouillon. In this medium the gonococci form a membrane on the surface, whereas the medium itself remains almost entirely clear. In preparing this medium animal blood-serum may be substituted for human serum, although the former is the better. Nevertheless, gonococci grow quite well on swine blood-serum.

*Heiman's*<sup>3</sup> *Chest Serum*.—Pleuritic or hydrothorax fluid is sterilized. To this is added 2 per cent. agar broth, 1 per cent. peptone, with or without 0.5 per cent. salt. Heiman believes that the excellence of this medium for the cultivation of gonococci is due to the large amount of albumin which it contains. Other fluids that may be substituted for the chest fluid are peritoneal fluid, chronic synovitis effusion, hydrocele fluid, pericardial fluid, the fluid contents of ovarian cysts, and hydro-salpinx fluid. Heiman, however, prefers the chest serum.

*Martin's*<sup>4</sup> *Medium*.—Beef-extract is prepared in the usual manner. To it are added 0.5 per cent. of disodium phosphate ( $\text{Na}_2\text{HPO}_4$ ), 1 per cent. of Witte's peptone, and 2 per cent. of powdered agar. The mixture is placed in a Koch sterilizer, and after the agar has been melted, and while still hot, the medium is titrated. For this purpose 5 c.c. of the sample medium is taken, to which are added two drops of 0.5 per cent. solution of phenolphthalein; normal sodium hydroxid solution is added from a buret until a faint but permanent pink color, which distinctly deepens on cooling, appears. This is taken as the end point, and if the medium is of the correct degree of acidity (0.6

<sup>1</sup> Baer: Jour. Infec. Diseases, 1904, vol. iv, pp. 313-326.

<sup>2</sup> Bowhill: Manual of Bact. Tech. and Special Bact., N. Y., 1902, p. 24.

<sup>3</sup> Heiman, H.: Med. Record, N. Y., vol. liii, p. 80.

<sup>4</sup> Martin, W. B.: Jour. Path. and Bact., July, 1910, p. 76.



per cent. to phenolphthalein or + 6 on Eyre's scale), 0.6 c.c. of soda solution will have been used (in the proportion noted). In practice, however, more alkali is at first required. For example, if 2 c.c. were used, then the medium is 1.4 per cent. to acid. This is corrected by adding to the medium, in bulk, normal sodium hydroxid solution in the proportion of 1.4 c.c. to each 100 c.c. of medium (usually somewhat more than the calculated figure is actually requisite). The reaction having been adjusted, the medium is filtered, tubed, and sterilized as usual. Care should be taken to avoid prolonged cooking, as this causes a darkening of the medium, and increases the difficulty of titration. If white-of-egg has been used for clearing purposes, allowance must be made for the fact that it is usually more acid than the medium. When properly prepared, the medium is nearly colorless and should possess only a moderate amount of water condensation. For use: On the surface of each slanted test-tube three or four drops of sterile (exposed to 57° C. for one and one-half hours) human blood-serum, obtained under aseptic conditions, are placed. The tubes are then tested overnight in the incubator, to make certain that they are still sterile. In case of plates, the serum is added to the agar after it has been melted and cooled to 45° C., in the proportion of 0.2 c.c. of serum to 5 c.c. of medium. To avoid drying, the test-tubes should be capped with sterile rubber. As gonococci are sensitive to room-temperature, it is best to make inoculations direct from subject to medium in the incubator when possible. After isolation it is advisable to make frequent subcultures to maintain recent strains. Martin prefers to isolate by means of stroke cultures rather than by shake plates, although in articular effusions the latter method is better, the centrifugated fluid being used. This medium has the advantages of transparency, economy of serum, and is suitable for either plates or slanted tubes.

*Duval's Method of Preparing Blood Agar.*—A base of 2 per cent. agar is prepared; peptone, 1 per cent. and sodium chlorid, 0.5 per cent., are added to beef infusion. This is corrected to 0.6 per cent. acid to phenolphthalein (hot titration) before sterilizing in the autoclave. To the tubed sterile agar, melted and cooled to a temperature of 52° C., is added a small quantity of sterile defibrinated human blood. From 4 to 7 drops of blood are added to each 6 to 10 c.c. of agar. The tubes are then shaken and slanted, or the contents poured into Petri dishes. By this means a beautiful, bright crimson, almost transparent, medium is obtained, possessing a moderate amount of water of condensation. If the agar is hotter than 60° C., when the blood is added, the hemoglobin is destroyed and a dirty brown mixture is the

result. If the agar is too cool, there will be no water condensation. This medium is improved by keeping it for one to two weeks before using. The tubes may be stoppered with rubber or, better, with paraffined corks. This medium is recommended by Gurd.<sup>1</sup>

Thalhimer<sup>2</sup> recommends the following for a simple laboratory method: Freshly drawn beef blood, obtained from an abattoir, is collected in a wide-mouthed jar and defibrinated by shaking with a number of medium-sized marbles. This is laked by adding an equal part of distilled water and rendered free from bacteria by means of a Reichel filter. The filtrate should be a clear red fluid. From 20 to 30 c.c. of this are added to 1 liter of sterile melted agar at 45° C., and the resulting mixture is then poured into sterile tubes. The medium that results is perfectly clear, bright red, and of the same shade as ordinary blood-agar. On this medium organisms that were unsuccessfully tested on hemoglobin agar were successfully passed through a number of generations. Gonococci grew luxuriantly. This method is a modification of former methods, notably that of Pfeiffer, and is believed to be the simplest yet devised for preparing blood-agar. It is evident that the hemolytic qualities of an organism cannot be tested with this medium.

*Young's<sup>3</sup> Media.*—Sterile hydrocele or ascitic fluid obtained by modern surgical methods is mixed with nutrient agar. A number of common agar slants are put in the autoclave for five minutes. This liquefies the agar and sterilizes the tubes and cotton stoppers. The slants are then put in a water-bath at 55° C. The stopper having been taken from a small flask of hydrocele fluid, the top of the flask is flamed and the fluid then poured on an agar tube, the top of which has been flamed, in proportions a little more than one to two. The agar tube is then stoppered and slanted. When plate cultures are to be used, sterile tubes containing about 7 c.c. of hydrocele fluid are employed. These are inoculated and mixed with melted agar slants at a temperature of 40° C., the two being poured separately into a Petri dish. Young prefers the slant method, and has kept gonococci alive on these for three months. The hydrocele or ascitic fluid, if uncontaminated, may be kept for several months before use.

According to some writers, human urine, sterilized by filtration through porcelain and added to a mixture of blood-serum and agar, facilitates the growth of the gonococcus. Cultures have also been grown on acid gelatin, gelatin containing acid urine, in acid urine itself,

<sup>1</sup> Gurd: Jour. Med. Research, 1910, vol. xxiii; n. s., vol. xviii, p. 154.

<sup>2</sup> Thalhimer, W.: Bull. Johns Hopkins Hospital, August, 1911, p. 293.

<sup>3</sup> Young, H. H.: Contributions to the Science of Medicine, Baltimore, 1900, p. 677.

and in albuminous urine with agar. These media are, however, uncertain and of doubtful value.

**Reaction of Culture-media.**—This detail is of the greatest importance, and inattention to it, or different testing methods employed, doubtless accounts for the many varying results obtained by different investigators in the cultivation of the gonococcus. Finger, Ghon,<sup>1</sup> and Schlagenhauser (1894) postulated a reaction frankly acid to litmus as essential. Thalmann<sup>2</sup> (1900) laid the optimum reaction between neutrality to litmus and neutrality to phenolphthalein. Vannon<sup>3</sup> prepared a medium faintly alkaline to litmus, and finally Gurd<sup>4</sup> proposed a medium of the reaction of 0.6 per cent. acid phenolphthalein, whereas Pollock and Harrison<sup>5</sup> recommend a reaction of + 6 Eyre's scale. Until comparatively recently litmus was the most generally used indicator for neutralizing media, adding normal sodium hydroxide solution until red litmus turned slightly blue or blue litmus a shade less blue. Phenolphthalein is a much more accurate and sharper indicator than litmus, and has the advantage of being colorless in acid solution and pink in alkaline. It should be remembered that different indicators vary not only in delicacy, but react differently to various substances. A medium that is alkaline to litmus may be acid to phenolphthalein, showing that there is present in such mixtures an acidity that litmus does not detect. These substances are organic compounds or acids, theoretically amphoteric, but in which the acid character predominates. Thus a liter of bouillon becomes, on the addition of 1 per cent. peptone, more alkaline to litmus, but decidedly more acid to phenolphthalein. In cultivating the gonococcus the reaction of the medium is of the greatest importance, and for this reason tests by phenolphthalein should always be resorted to. In using phenolphthalein care must be taken to eliminate the effects of carbon dioxide, which is acid to phenolphthalein. For convenience sake titrations of media should be made as nearly 100 c.c. as possible. All media should invariably be tested for twenty-four hours in an incubator at 37° C., immediately prior to its use, to ascertain its sterility.

**Appearance of Colonies.**—Colonies of gonococci can usually be detected macroscopically at the end of twenty-four hours; however, gonococci vary somewhat in the speed with which they develop colonies, and for this reason it is advisable to incubate suspected cultures for at least three days unless a growth is obtained prior to this time.

<sup>1</sup> Ghon, Pfeiffer, and Sederl: *Zeit. f. klin. Med.*, 1902, vol. xl.      <sup>2</sup> Thalmann: *Loc. cit.*

<sup>3</sup> Vannon: *Cent. f. Bakt. u. Parasitenk.*, vol. xl, p. 162; *ibid.*, 1907, 1. Abt., orig. vol. xlv, p. 10.

<sup>4</sup> Gurd: *Loc. cit.*

<sup>5</sup> Pollock, C. E., and Harrison, L. W.: *Gonococcal Infections*, London, 1912.

As a general rule, it may be stated that gonococci grow slowly on artificial media, and that a delicate growth is characteristic. Colonies are usually small. Their appearance varies somewhat with the medium on which they are cultivated. In color, the colonies are grayish-white, opalescent, with often a tinge of yellow, especially toward the center. At the end of twenty-four hours they usually appear as small, isolated, circular, raised, translucent, finely granular colonies, the edges of which are scalloped or crinkled. The margins appear to fade gradually into the surrounding culture-medium. The granular appearance is particularly noticeable toward the periphery. In the center, small grayish or yellowish punctate spots of high refraction are often seen. Surface streak cultures usually appear as translucent, granular, grayish-white growths with rather well-defined thick edges. At the end of three days colonies frequently measure only 1 or 2 mm. in diameter. Under careful cultivation on suitable medium, colonies may, however, attain a diameter of 1 or 2 cm. Cultures grown on the Wertheim<sup>1</sup> medium, at the end of twenty-four hours appear as previously described. The superficial colonies exhibit a dark spot in the center, from which a delicate, finely granular coating extends around the colony. The deeper colonies are grayish-white and present an uneven appearance. At the end of two or three days they acquire somewhat the shape of a blackberry, whereas on the surface there is a moist, yellowish growth, from the border of which, under the low power, small processes may be seen extending. At this stage such cultures must be transplanted or the colonies are likely to perish. In reinoculating from the colonies they are found to consist of shining, tenacious, compact masses. Stroke cultures on oblique, solidified blood-serum-agar (Wertheim<sup>2</sup>) produce moderately luxuriant growths. At first these appear as isolated, grayish colonies, which later become moist, slimy, and tenacious, and from the margins of which a film-like coating extends. Gonococci do not liquefy blood-serum. Growth on Martin's<sup>3</sup> medium appears in from eighteen to twenty-four hours. The colonies are minute, semitransparent, slightly elevated discs, presenting to the naked eye a moist, glistening surface. By low power, with transmitted light, they appear almost transparent, and are a light grayish yellow. They are homogeneous, the ground-substance being finely granular. They have definite uniform margins, which, with the high power, are seen to be slightly toothed. As the colonies enlarge they tend to remain discrete; the center thickens and becomes more opaque, owing to the development of numerous ovoid, coarse granules. At the end of

<sup>1</sup> Wertheim: Arch. f. Derm. u. Syph., 1899, vol. xli, No. 1.

<sup>2</sup> Wertheim: *Loc. cit.*

<sup>3</sup> Martin, W. B.: Jour. Path. and Bact., July, 1910, p. 76.

from forty-eight to seventy-two hours the margins are scalloped. Thus radial striations develop, and concentric rings, due to different zones of opacity, also appear. Finally, when about a week old, coarser granules become visible. These are often so white and opaque in contrast to the remainder of the colony as to suggest contaminations. The growths may readily be removed on a platinum loop, and are distinctly viscous in consistence, although neither slimy nor tenacious. On Duval's medium colonies can be macroscopically distinguished in from eighteen to twenty-four hours, occasionally being delayed for forty-eight hours. When the colonies are fully developed they appear as watery-looking, bluish gray or almost colorless, semitransparent, small, round excrescences having a fairly well-developed outline. At the end of seventy-two hours colonies show a tendency to spread from the periphery in a somewhat irregular manner.

In old cultures the appearance of the colonies varies widely. At times they may be found to be simply a mass of more or less Gram-negative material. Heiman<sup>1</sup> has maintained a culture for three months, but this is an exceptionally long period for a culture to exist without transplanting. As a rule, they die in a much shorter period. The morphology of the individuals of very old colonies often in no way resembles ordinary gonococci. Nevertheless, such material re-inoculated on suitable culture-medium may produce gonococci that are typical in mode of growth, staining reaction, morphology, and in pathogenic character. A successful inoculation from a culture of the twelfth generation was performed by Aufuso. A similar result was obtained by Bumm from the twentieth generation.

**Method of Testing Colonies.**—(1) Films may be prepared and stained with the ordinary stains and by Gram's method. Few cocci other than the gonococci are Gram-negative. (2) Subcultures should be made on ordinary agar. If the organism is the gonococcus, there is no growth. (This applies only to freshly isolated cultures. Occasionally certain strains of gonococci will be encountered, which, after having been grown on artificial media for a number of generations, seem to adapt themselves to their surroundings and will thus grow on ordinary laboratory media.) There is no growth on gelatin.

**Animal Experimentation.**—The gonococcus is strictly parasitic (Bumm<sup>2</sup>), and seems to attack man exclusively, for gonorrhea cannot be produced in the lower animals. Even the anthropoid apes are

<sup>1</sup> Heiman: Studies from the Path. Lab., College Physicians and Surgeons, New York, 1895, p. 3.

<sup>2</sup> Bumm: Veit's Handbuch der Gynäkologie, vol. ii.

immune to this disease (Wildbolz<sup>1</sup>). Neisser inoculated dogs, with negative results. Löffler and Leistikow<sup>2</sup> inoculated the abraded conjunctiva and urethra of rabbits and guinea-pigs without result. Krouse<sup>3</sup> attempted to infect rabbits, cats, pigeons, and mice. Wertheim<sup>4</sup> claims to have produced a mild peritonitis in mice, rabbits, and rats by inoculation of gonococci. Finger also has reported having produced an inflammation of the knee-joint of a dog from a pure culture of gonococcus grown on serum-agar. These results were probably produced by toxins which are present in both the living and the dead gonococci. Indeed, it is to these substances that the discharge of gonorrhea is attributed.

**Toxins.**—The gonococcus develops a gonotoxin. This is present in the cells after heating and contact with alcohol. The production of a toxin has been demonstrated by Wassermann,<sup>5</sup> de Christmas,<sup>6</sup> and others. There is still some doubt as to the exact nature of the toxin, some believing that it is set free only by the disintegration of the gonococci,—in other words, an endotoxin,—whereas other authorities consider it a product of bacterial metabolism.

Rogers and Torrey<sup>7</sup> state that the repeated injection of free gonotoxin in culture-media had a disastrous effect on rabbits that were used in the production of antigonococcic serum. Although the animals suffered little from the first 5 or 6 inoculations, they soon after reached a condition of hypersensitiveness to the toxin and finally succumbed to a dose that would never have proved fatal to a normal animal. This seems to indicate, as Wassermann<sup>8</sup> and others have pointed out, that the toxin in culture-media is not produced in diffusible form by the living gonococcus cells, but is an endotoxin derived from the dead and disintegrated gonococci.

Injections of small quantities of gonotoxin in rabbits or mice produce no results. In large quantities fever, infiltration, and sometimes necrosis are produced. If the injections are persisted in or the doses are very large, loss of weight and, finally, death occur. Inoculated into the urethra of man, a transient urethritis is produced. The toxin injected into the cellular tissue of man produces a painful cellulitis

<sup>1</sup> Wildbolz, H.: Zent. f. Bakteriologie, vol. xxxi, No. 4.

<sup>2</sup> Löffler and Leistikow: Charité-Annalen, 7. Jahrg.

<sup>3</sup> Krouse: Cent. f. Augenheilk., 1882, p. 134.

<sup>4</sup> Wertheim: Arch. f. Dermat. u. Syph., 1899, vol. xli, No. 1.

<sup>5</sup> Wassermann: Zeit. f. Hyg. u. Infektions-Krankh., vol. xxvii, No. 2; also Berlin. klin. Woch., 1897, No. 32.

<sup>6</sup> de Christmas: Ann. Institut Pasteur, 1897; also *ibid.*, 1900, vol. xlv, p. 331.

<sup>7</sup> Rogers, J., and Torrey, J. C.: Jour. Amer. Med. Assoc., September 14, 1907.

<sup>8</sup> Wassermann: Quoted by Rogers and Torrey: *Loc. cit.*



which lasts several days. Repeated injections probably give no immunity.

The filtrate prepared from recent cultures of gonococci contains little or no toxin.

The exact part which the toxin plays in the production of infection is still undetermined. It is not known if the poison is capable alone of producing metastases, or if any parts of the body are especially susceptible to it, if it can diffuse itself throughout the body, or if its action is purely local and intimately associated with the presence of the gonococcus itself.

Nikolaysen<sup>1</sup> claims to have isolated the toxin by means of distilled water or sodium hydroxid from the bacterial bodies. This toxin is found to remain active after complete drying or after exposure to 120° C. of heat. Nikolaysen found the toxin quite as poisonous to animals as was a pure culture of living gonococci, 0.01 gram killing a white mouse. Specific injury to the nervous system by the injection of a gonococcal toxin has been described by Moltchanoff.<sup>2</sup>

**Immunity.**—If man possesses any immunity at all, it is extremely transient—so short lived, in fact, as to be of no practical value. On account of the chronicity and frequent latency of gonorrhea, this point is difficult to determine positively. Animals may be partially immunized to the toxin, in which case their blood is said to possess slight antitoxic and bactericidal properties. Torrey<sup>3</sup> has produced immunity in guinea-pigs.

**Agglutination.**—This test is of no great practical diagnostic value. The gonococci, like certain other pathogenic cocci, possess many strains that differ markedly in their specific character and have but few common agglutinins.

**Bacteriologic Properties of Micrococci Likely to be Confused with the Gonococcus.**—Under this heading may be placed a group of microorganisms known as the pseudogonococci. This name has been applied to them by Mannaberg, Lustgarten, and Bumm.<sup>4</sup> These organisms are morphologically very similar to the gonococcus, but may be distinguished from the latter by their method of growth and staining properties. The identity of this group of microorganisms as special germs has been established. They are usually regarded as varieties of skin or air cocci that have accidentally obtained access to the genital tract.

*Micrococcus Citreus Conglomerata* (Bumm<sup>4</sup>).—This microorganism

<sup>1</sup> Nikolaysen: Cent. f. Bakt., 1897; also Fort. d. Med., 1897, vol. xxi.

<sup>2</sup> Moltchanoff: Münch. med. Woch., 1899.

<sup>3</sup> Torrey, J. C.: Med. Research, 1908, p. 347.

<sup>4</sup> Bumm: Veit's Handb. der Gyn., vol. ii.

is morphologically similar to the gonococcus. It is Gram-positive, easily cultivated, and forms colonies that grow on and dissolve gelatin. On the surface of the latter the micrococcus grows rapidly and forms a moist, shining, unwrinkled growth. The organism is not pathogenic. It is found in the air and in gonorrheal pus.

*Diplococcus Albicans Amplus* (Bumm<sup>1</sup>).—This diplococcus is found in the normal lochia, and is considerably larger than the gonococcus. It liquefies gelatin, and on this medium produces a grayish-white colony. Its growth is moderately rapid. In staining reaction the organism is Gram-positive.

*Diplococcus Albicans Tardissimus* (Bumm).—This micrococcus is Gram-positive, and has been found in urethral pus. On the usual culture-media it grows slowly at ordinary temperatures, but more rapidly at 37° C. It does not liquefy gelatin. Colonies appear as small white excrescences that, under the low power, are opaque, semi-translucent, and brown. Agar stroke cultures present a grayish-white growth. In old colonies the surface is wrinkled.

*Micrococcus Subflavus* (Bumm).—Is Gram-positive and has been found in the lochia and urethra of healthy women. This micrococcus grows slowly on all media. On gelatin it produces a moist, yellowish-brown colony that liquefies the medium slowly. On potatoes the *Micrococcus subflavus* produces, at the end of two or three weeks, crescent-shaped colonies that have a wrinkled-skin-like surface and are light brown in color. Pathogenesis: Has no action on mucous membranes, but when injected into cellular tissue produces an abscess in the pus of which large numbers of diplococci may be found. Wormser<sup>2</sup> states that the *Micrococcus fallax* may be mistaken for the gonococcus, but may be distinguished from the latter by culture methods. This author states that the *Micrococcus fallax* does not react regularly with Gram's stain, but is usually negative. The coccus is easily destroyed by weak alkaline solutions, but is extremely resistant to solutions of potassium permanganate. The gonococci may be distinguished from the pseudogonococci by the fact that—(a) The former can usually be found intracellularly. (b) They are Gram-negative. (c) They do not grow on gelatin (at least in the first generation, and only very exceptionally at any time). (c) The micrococci just mentioned are all easily cultivated, whereas the gonococci grow only sparingly and with difficulty, and only upon special media. The fermentation test is here of value. This depends upon the acid reaction, which is produced by the growth of the organism with various sugars. The

<sup>1</sup> Bumm, E.: *Der Mikro-organismus gonorrhöischen Schleimhaut-Erkrankungen*, Wiesbaden, 1885.

<sup>2</sup> Wormser, L.: *Annal. des Maladies Gen.-Urin.*, March 20, 1910.



organism is grown in litmus broth and aseptic fluid containing glucose, galactose, maltose, or saccharose. According to Mayou,<sup>1</sup> the following reaction is obtained: The gonococcus gives an acid reaction with glucose and galactose. Meningococcus gives an acid reaction with glucose, but not with galactose. *M. catarrhalis* gives no reaction with either.

Elser and Huntton<sup>2</sup> present the following table, showing the value of sugar fermentation in the identification of the aforementioned bacteria:

STRAINS TESTED	STRAINS	DEX- TROSE	MAL- TOSE	LEVU- LOSE	SACCHA- ROSE	LAC- TOSE	GALAC- TOSE
Meningococcus.....	200	+	+	0	0	0	0
Pseudomeningococcus.....	6	+	+	0	0	0	0
Gonococcus.....	15	+	0	0	0	0	0
Micrococcus catarrhalis.....	64	0	0	0	0	0	0
Micrococcus pharyngeus sicus.....	2	+	+	+	+	0	0
Chromogenic Group I.....	28	+	+	+	+	0	0
Chromogenic Group II.....	11	+	+	+	0	0	0
Chromogenic Group III.....	9	+	+	0	0	0	0
Jaeger meningococcus (Kral).....	1	+	+	+	+	+	+
Diplococcus crassus (Kral).....	1	+	+	+	+	+	+

*Meningococcus* or *Diplococcus Intracellularis Meningitidis*.—This micrococcus is Gram-negative. It gives luxuriant and rapid growth on a wide variety of media. In serum bouillon it produces a turbidity that is later deposited at the bottom of the test-tube. The young colonies have delicate, almost invisible margins, the centers of which later become grayish-white. The meningococcus is occasionally present in the female genital tract. It may produce ophthalmia, and has been found in the blood and spinal fluid. The enzymotic properties are irregular and similar to those of the gonococcus. Both organisms act in much the same manner when kept in the same media and environment, but the meningococcus is the stronger grower (Flexner<sup>3</sup>). This is especially so of cultures two or more days old. The meningococcus is frequently found in or on the cells.

Pollock and Harrison<sup>4</sup> sum up the differences between the gonococcus and the meningococcus when grown on artificial media by stating that, in general, the meningococcus is less sensitive to changes in temperature and reaction of the medium, grows more rapidly on serum agar, and its colonies are more opaque than those of the gonococcus, and that it can generally be cultivated on plain nutrient agar. The

<sup>1</sup> Mayou: The Practitioner, London, 1908, pp. 125, 200, and 354.

<sup>2</sup> Elser and Huntton: Quoted by P. H. Hiss and H. Zinsser: A Text-book of Bacteriology, 1910, p. 387.

<sup>3</sup> Flexner, S.: Jour. Exper. Med., March, 1907.

<sup>4</sup> Pollock, C. E., and Harrison, L. W.: Gonococcal Infections, London, 1912, p. 20.

meningococcus degenerates even more rapidly than the gonococcus. The meningococcus forms acid with maltose and dextrose, while the gonococcus ferments dextrose only. Martin<sup>1</sup> states that on his medium the edges of the colonies of the meningococcus are more transparent than are the colonies of the gonococcus.

*Micrococcus Catarrhalis*.—This organism was first described by R. Pfeiffer<sup>2</sup> in 1896, and in the same year is referred to by Frosch and Kolle. Later Ghon, H. Pfeiffer, and Sederl<sup>3</sup> and von Lingelsheim<sup>4</sup> carefully studied this microorganism.

Its habitat is the respiratory tract, especially the nose, mouth, and throat. It has also been found in the eyes. Gurd<sup>5</sup> and others have found this micrococcus present in the inflamed genital tract of men and women. According to Gurd, the micrococci described by von Lingelsheim,<sup>6</sup> and called by him *Micrococcus pharyngeus sicca*, *M. pharyngeus cinereus*, *Diplococcus pharyngeus flavus* I, *D. pharyngeus flavus* II, and *D. pharyngeus flavus* III, differ from the *Micrococcus catarrhalis* and one another only in the amount of pigment that they develop, and which gives them their yellow color. In differentiating these micrococci from the gonococci Gurd lays especial stress on the fact that the latter produce a delicate growth, which is comparatively restricted to serum media of a particular reaction. This microorganism is Gram-negative, and grows readily on gelatin at room temperature. It is an active grower on most media. In serum bouillon it forms a scum, and later deposits, but does not produce turbidity. The colonies have an opaque, white, shining appearance. Park and Williams<sup>7</sup> state that the *Micrococcus catarrhalis* does not liquefy gelatin, and that on bouillon it produces a cloudy growth, with, often, the development of a pedicle. Milk is not coagulated by this microorganism, but dextrose serum may be. As the colonies develop the centers become elevated and the edges crenated. The surface colonies of gonococci are grayish, bluish, or whitish, and are radially plicated, concentrically striated, have granular centers, scalloped margins, and present a poor growth (slight granular deposits) in serum bouillon.

Libman and Celler<sup>8</sup> found that the *Micrococcus catarrhalis* was

<sup>1</sup> Martin, W. B.: Jour. Path. and Bact., July, 1910.

<sup>2</sup> Pfeiffer, R.: Die Mikroorg., third edition, 1896.

<sup>3</sup> Ghon, Pfeiffer, and Sederl: Zeit. f. klin. Med., 1902, vol. xl.

<sup>4</sup> von Lingelsheim: Klin. Jahrbuch, 1906, vol. 2.

<sup>5</sup> Gurd: Jour. Med. Research, 1910, vol. xxiii; n. s., vol. xviii, p. 154.

<sup>6</sup> von Lingelsheim: Loc. cit.

<sup>7</sup> Park and Williams: Pathogenic Bacteria and Protozoa, New York, 1908.

<sup>8</sup> Libman and Celler: Reports of Mt. Sinai Hospital, 1903.

more nearly oval in form than the gonococcus, and slightly larger. Ayres<sup>1</sup> believes that this organism is responsible for a definite proportion of cases of urethritis; that these infections are characterized clinically by the mildness of their onset, and are often mistaken for gonorrhea. According to Ayres,<sup>2</sup> such cases should not be treated locally, as they get well without treatment, whereas the application of silver preparations may cause them to continue indefinitely. The same writer reports cases of pelvic inflammatory diseases due to the *Micrococcus catarrhalis*, one being a mixed infection with the staphylococcus, and the other being due probably to the *Micrococcus catarrhalis* alone. Hiss and Zinsser<sup>3</sup> and Libman and Celler<sup>4</sup> state that the *Micrococcus catarrhalis* is of slight pathogenicity.

In 1906 von Lingelsheim<sup>5</sup> described the *Diplococcus mucosa*. The colony formation is similar to the meningococcus, but is somewhat more mucoid in character. This microorganism can easily be distinguished from the former and from the gonococcus by capsular stains, as by them it will be found to possess a distinct capsule.

**Bacteriologic Diagnosis of Gonorrhea.**—In the great majority of acute cases gonorrhea may, to all intents and purposes, be diagnosed positively by the morphology and staining reaction of the gonococcus found in film preparations, and this is especially true in the male. No other micrococcus possessing the same appearance and staining properties, and capable of producing the clinical symptoms of an acute severe urethritis, has ever been demonstrated in cultures from this region. In chronic cases staining methods offer a less certain means of diagnosis, not only because the gonococci are present in reduced numbers, but particularly on account of the fact that in these cases the specific micrococcus is often atypical in size, shape, and staining reaction. Finger, Schaeffer and Steinschneider,<sup>6</sup> and Galewski found that a Gram-negative diplococcus which was not the gonococcus occurred in only from 4.6 per cent. to 4.8 per cent. of cases in a large series. This shows that over 95 per cent. of cases can be correctly diagnosed by the Gram method of staining. In all cases of doubt—and this refers particularly to old chronic or latent cases, where the patients desire to marry, and in every case in which the medicolegal aspect is likely to be involved, or where an absolute diagnosis is desired, as in the case of rare lesions—cultures should be made. Because of the difficulty

<sup>1</sup> Ayres, W.: Amer. Jour. Surg., New York, March, 1912, p. 101.

<sup>2</sup> Ayres: *Loc. cit.*

<sup>3</sup> Hiss, P. H., and Zinsser, H.: A Text-book of Bacteriology, 1910.

<sup>4</sup> Libman and Celler: *Loc. cit.*

<sup>5</sup> von Lingelsheim: Klin. Jahrb., 1906, vol. xv.

<sup>6</sup> Schaeffer and Steinschneider: Kong. Deut. Dermat. Gesell., Breslau, 1894.

in cultivating the gonococcus on artificial soil the cultures should be undertaken only by an experienced bacteriologist. If negative results are obtained, either by the staining or by the culture method, repeated examination should be made under the most favorable circumstances.

McFarland<sup>1</sup> summarizes the characteristics of the gonococcus as follows: Non-sporogenous, non-liquefying, non-chromogenic, non-flagellate, aerobic, strictly parasitic, not stained by Gram's method, requiring special culture-media, and pathogenic only to man. Indeed, Wertheim<sup>2</sup> and Schanz<sup>3</sup> state that negative culture tests must be always viewed with suspicion on account of the capriciousness with which many strains of gonococci grow even upon the most favorable artificial media. Of late years, however, the routine cultivation of the gonococcus on artificial media has been carried out with marked success. Thus Butler and Long<sup>4</sup> state that they experienced no difficulty in cultivating this organism from a large series of cases, and while it is undoubtedly true that the gonococcus requires a special medium for its development and care must be exercised regarding the temperature at which it is incubated, it seems probable that in the past the difficulty in cultivating the organism has been somewhat overestimated. A point of the utmost importance in securing material for cultures is that, when possible, the material be obtained by curetage of the diseased area. Thus in arthritis the joint fluid, be it serum or pus, will be negative in a much larger proportion of cases than will be particles of the granulation tissue that can be secured by scraping the cavity. Gurd<sup>5</sup> has emphasized this point regarding cultures from pus-tubes, and states that the negative results often obtained are due to this fact. It is well known that prolonged encapsulation tends to destroy the vitality of the gonococcus, which will often be dead or of greatly lessened virulence in pus, while active organisms may be found in the walls of the abscess.

#### DIAGNOSIS OF GONORRHEA BY THE COMPLEMENT-FIXATION TEST

In 1906 Müller and Oppenheimer<sup>6</sup> suggested applying the complement-fixation test as a means of diagnosis in cases of gonorrhea, and

<sup>1</sup> McFarland, J.: A Text-book upon Pathogenic Bacteria and Protozoa, Philadelphia and London, 1912.

<sup>2</sup> Wertheim: Arch. f. Dermat. u. Syph., 1899, vol. xli, No. 1.

<sup>3</sup> Schanz: Deut. med. Wochenschr., Leipzig and Berlin, 1904, vol. xxx, p. 350.

<sup>4</sup> Butler, W. J., and Long, J. P.: Ill. Med. Jour., 1908, vol. xiii, p. 538.

<sup>5</sup> Gurd: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, p. 154.

<sup>6</sup> Müller and Oppenheimer: Wien. klin. Woch., 1906, No. 19, p. 894.

reported one case in which the method had been successful. Further investigations on this subject have been published by Bruck,<sup>1</sup> Meakins,<sup>2</sup> Vannod,<sup>3</sup> Wollstein,<sup>4</sup> Torrey,<sup>5</sup> Watabiki,<sup>6</sup> Köhler,<sup>7</sup> Eising,<sup>8</sup> Gradwohl,<sup>9</sup> and Schwartz and McNeil.<sup>10</sup> The last-mentioned investigators have applied the complement-fixation test to a series of 324 human sera. These sera were taken from persons of both sexes having acute or chronic gonorrheal infection; from others having no history of clinical manifestations of gonorrhea, and from patients suffering from various diseases other than gonorrhea. Schwartz and McNeil used many different strains of gonococci in the preparation of the antigen; in other words, a polyvalent antigen. In the great majority of the cases tested, clinically 12 strains of gonococci were used in the preparation of the antigen. This antigen seemed to give more uniformly accurate results than some prepared from only 6 strains. In their work they used both antishoop and antihuman hemolytic sera and followed the technique laid down in the well-known Wassermann test for syphilis, and in Noguchi's modification of the Wassermann test. Among 29 women in whom gonorrhea was definitely present or suspected, 23 were positive and 6 were negative. Among a miscellaneous series of 20 cases, in none of which a history or physical signs of gonorrhea were present, 10 were positive and 10 negative. In a series of pregnant women the following results were obtained: 35 cases showed no signs of gonorrhea; 14 were positive and 21 negative. One pregnant gonorrheic was positive and one pregnant patient with a marked antepartum discharge in which no gonococci were found was negative. The table on p. 82 is a summary of the results obtained by Schwartz and McNeil.

In a later communication Schwartz and McNeil<sup>11</sup> confirm their previous conclusions. They state that a positive reaction can rarely be obtained before the fourth week of the disease, and that the reaction

<sup>1</sup> Bruck, C.: Deutsche med. Woch., 1906, xxxii, p. 1368.

<sup>2</sup> Meakins: Johns Hopkins Hosp. Bull., 1907, No. 18, p. 255.

<sup>3</sup> Vannod, T.: Zentrabl. f. Bakt., 1907, No. 44, orig. 10, 110; also Deut. med. Wochenschr., 1906, vol. xxxii, p. 1984.

<sup>4</sup> Wollstein: Jour. Exper. Med., 1907, No. 9, p. 588.

<sup>5</sup> Torrey, J. C.: Jour. Med. Research, 1907, No. 17, p. 223.

<sup>6</sup> Watabiki, T.: Jour. Infec. Dis., 1910, No. 7, p. 159.

<sup>7</sup> Köhler, R.: Wien. klin. Wochenschr., November 9, 1911; Value of the Complement-Fixation Test in Gonorrhea (Queries and Minor Notes, Jour. Amer. Med. Assoc., March 23, 1912, p. 881); Gonorrheal Complement-Fixation Reaction, Abstract and Discussion (*ibid.*, April 27, 1912, p. 130).

<sup>8</sup> Eising, E. H.: Med. Record, June 1, 1912.

<sup>9</sup> Gradwohl, R. B. H.: Amer. Jour. Dermat., 1912, vol. xvi, No. 6, p. 294.

<sup>10</sup> Schwartz, H. J., and McNeil, A.: Amer. Jour. Med. Sci., 1911, new series, vol. cxli, p. 693.

<sup>11</sup> Schwartz, H. J., and McNeil, A.: Amer. Jour. Med. Sci., December, 1912, p. 815.

persists for seven or eight weeks after cure; that the reaction is often absent if only the anterior urethra is involved.

CLINICAL DIAGNOSIS	TOTAL NUMBER OF CASES	POSITIVE		NEGATIVE	
		Number	Per Cent.	Number	Per Cent.
1. Acute gonorrheal urethritis:					
(a) Duration three days to three weeks . . . . .	5	0	0	5	100
(b) Duration not stated . . . . .	1	1	100	0	0
2. Acute urethritis:					
Gonococcus not found . . . . .	1	0	0	1	100
3. Chronic urethritis (gonorrheal):					
(a) Gonococcus present . . . . .	4	4	100	0	0
(b) Gonococcus not found . . . . .	36	27	80	9	20
(c) No examination made for gonococci, but serum taken from cases at stage when gonococci are usually absent . . . . .	8	7	90	1	10
4. Chronic urethritis:					
Gonorrhea doubtful . . . . .	4	1	25	3	75
5. Chronic prostatitis:					
(a) Gonorrheal history . . . . .	25	17	68	8	32
(b) Gonorrheal history doubtful . . . . .	2	1	50	1	50
6. Sterility, gonorrheal history . . . . .	3	1	33	2	66
7. Epididymitis:					
(a) Gonorrheal history . . . . .	3	2	66	1	33
(b) Gonorrhea denied . . . . .	4	1	25	3	75
8. Verumontanum cases:					
(a) Gonorrheal history . . . . .	17	11	64	6	35
(b) Gonorrhea denied . . . . .	6	2	33	4	66
9. Miscellaneous cases with no sign or history of gonorrhea . . . . .	20	0	0	20	100
10. Gonorrhea in male clinically cured . . . . .	51	22	43	29	57
11. Cases treated with bacterins . . . . .	7	7	100	0	0
12. Joint affections:					
(a) Gonorrheal arthritis . . . . .	14	14	100	0	0
(b) Gonorrheal arthritis questionable . . . . .	7	4	57	3	43
(c) Other joint affections . . . . .	9	1	11	8	89
13. Pregnancy cases taken from public maternity hospitals . . . . .	38	15	39	23	61
14. Gynecologic cases:					
(a) Gonorrhea definitely present or suspected . . . . .	29	23	79	6	21
(b) Cases with no signs or history of gonorrhea . . . . .	30	10	33	20	66

It would seem, from the foregoing, that the complement-fixation test should be a decided adjunct in the field of clinical pathology as an aid in the diagnosis of gonorrhea. Swinburne<sup>1</sup> and Keyes<sup>2</sup> regard this test very highly. Schmidt<sup>3</sup> presents the following results, which he has obtained in 77 cases:

<sup>1</sup> Swinburne, G. K.: Trans. Amer. Urol. Assoc., 1912, vol. v, p. 21.

<sup>2</sup> Keyes, Jr., E. L.: Trans. Amer. Urol. Assoc., 1912, vol. v, p. 40.

<sup>3</sup> Schmidt, L. E.: *Ibid.*, p. 30.

CLINICAL DIAGNOSIS	NUMBER OF CASES	POSITIVE		NEGATIVE	
		Number	Per Cent.	Number	Per Cent.
Acute gonorrhea	14	1	7	13	91
Chronic gonorrhea	32	15	46	17	54
Epididymitis	11	5	45	6	55
Arthritis	5	2	40	3	60
Gonorrheal history of from one to ten years	27	2	8	25	92
Gonorrheal history negative	11	0	0	11	100

It seems to be of especial value in the diagnosis of joint conditions. Schmidt,<sup>1</sup> after having tested the complement-fixation test in 103 cases, states that the results indicate that a negative test in a patient is good evidence that the disease is cured. Gardner and Clowes<sup>2</sup> report that in a series of 106 gonorrheal cases 23 showed a three-plus reaction, 15 a two-plus, 23 a one-plus, whereas 37 were negative. Of the 23 cases showing a three-plus reaction, 20 were examined, in 18 of which an intracellular diplococcus was found. Of the 15 cases giving a two-plus reaction, 13 were examined, in 9 of which an intracellular diplococcus was demonstrated. Of the 23 cases showing a one-plus reaction, 17 were examined, and in 11 an intracellular diplococcus discovered. These authors believe that the three-plus and two-plus reactions are fairly diagnostic of the presence of gonorrhea, while a one-plus reaction, without being confirmed by clinical data, should not be regarded more seriously than should a one-plus Wassermann reaction. Gradwohl,<sup>3</sup> after an experience with 50 cases tested with the complement-fixation test, states that this test does not appear to have nearly so many limitations as does the Wassermann test for syphilis. It is a genuine antigen-antibody test. A gonorrheal fixation test once positive and later negative is of great value in estimating a cure. In persons recently infected the test is apt to be negative. Schwartz<sup>4</sup> states that a positive reaction should not be expected earlier than about the beginning of the fourth week from the onset of the infection. Irons<sup>5</sup> states that occasionally in adults, and more frequently in children, a fairly positive reaction occurs in persons who have never had gonorrhea. It would seem that the test should be especially valuable in the case of women in whom, during the chronic stage, gonococci are very difficult to demonstrate.

To be of any value whatever, the complement-fixation test must be carried out by a skilled bacteriologist, and every technical pre-

<sup>1</sup> Schmidt, L. E.: Jour. Amer. Med. Assoc., April 27, 1912, p. 1307.

<sup>2</sup> Gardner and Clowes: Jour. Amer. Med. Assoc., April 27, 1912, p. 1307.

<sup>3</sup> Gradwohl, R. B. H.: Amer. Jour. Dermat., June, 1912.

<sup>4</sup> Schwartz, H. J.: Amer. Jour. Med. Sci., September, 1912, vol. cxliv, No. 3.

<sup>5</sup> Irons, E. E.: Jour. Infect. Diseases, July, 1912, p. 77.



caution observed. A positive reaction indicates a focus of gonorrhea in some part of the body, but a negative test does not necessarily exclude the disease. It is at once apparent that acute gonorrhea will not show a positive result until sufficient time has elapsed to permit the absorption of enough toxin to cause a systemic response to invasion, as shown by the antibodies of various types in the serum. The test is usually negative until about the third or fourth week. In subacute or chronic gonorrheas the chances of a positive result are greatly increased, the percentage of positive results being about as high as in similar tests for syphilis. In cases of gonorrhea that are supposedly cured, a positive reaction would indicate a focus of infection somewhere in the system of such virulence that transmission of the disease would be more than likely to follow, provided the focus was so situated that transmission was possible. But it must be remembered that gonorrheal antibodies persist for some time after the disappearance or destruction of the invading gonococci.

A negative result cannot justify in any way the exclusion of gonorrhea, as in not a few cases that have been bacteriologically proved to be gonorrhea a negative reaction was obtained. Gardner and Clowes<sup>1</sup> state, however, that in the 185 tests made by them a positive reaction was never obtained in any but a gonorrhoeic. Schwartz,<sup>2</sup> after reviewing additional cases than those previously recorded, concluded that the test is of great practical value. O'Neil,<sup>3</sup> after a series of 256 tests, is of a similar opinion.

More research will be required before the exact value and scope of the complement-fixation test can be definitely determined.

**Diagnostic Vaccination.**—In 1908 Irons<sup>4</sup> noted that subcutaneous inoculation of dead gonococci in persons suffering from gonorrhea frequently was followed in from twelve to twenty-four hours by local and general reaction. This reaction consists of an area of redness, swelling, and tenderness at the site of the inoculation, often an increased pain and tenderness in affected joints and other localizations, together with symptoms of malaise and sometimes increase in fever and leukocytosis. These phenomena resemble those seen in the tuberculin reaction, and are of value in the diagnosis of obscure cases in which gonococcal infection is suspected. This reaction has been noted by many investigators. Reiter<sup>5</sup> observed the reaction in women suffering from pelvic inflammatory diseases of gonococcal origin. Irons<sup>6</sup> states that in positive

<sup>1</sup> Gardner, J. A., and Clowes, C. H. A.: *New York Med. Jour.*, October, 1912, p. 734.

<sup>2</sup> Schwartz, H. J.: *Amer. Jour. Med. Sci.*, September, 1912, p. 369.

<sup>3</sup> O'Neil, R. F.: *Boston Med. and Surg. Jour.*, October 3, 1912, p. 464.

<sup>4</sup> Irons, E. E.: *Jour. Infect. Dis.*, 1908, vol. v, p. 279.

<sup>5</sup> Reiter: *Zeitschr. f. Geburtsh. u. Kinderh.*, 1911, vol. lxxviii, p. 471.

<sup>6</sup> Irons, E. E.: *Jour. Amer. Med. Assoc.*, March 30, 1912, p. 931.



cases an area of hyperemia 5 to 10 mm. in diameter appears around the point of inoculation, and that not infrequently a definite papule develops. Sakaguchi<sup>1</sup> has arrived at similar conclusions. Sternberg<sup>2</sup> concludes, after an extensive study of this subject, that the diagnostic vaccination is of much practical aid in the diagnosis of gonorrhea. In normal persons used as a control either no reaction occurs, or at most a small area of redness, 2 to 3 mm. in diameter, develops. Eising<sup>3</sup> recommends intradermal injections, and states that these are followed by a more pronounced reaction than either epidermal or subdermal. This author states that the papule measures from 3 to 5 mm., is slightly tender, and often surrounded by an areola 5 to 10 mm. in diameter. The papule appears in from twelve to twenty-four hours after inoculation, and persists for a varying period, but never longer than one week. Slingenberg,<sup>4</sup> von de Velde,<sup>5</sup> Recio,<sup>6</sup> London,<sup>7</sup> and others report favorably upon the diagnostic value of vaccine. Like other tests, this will, no doubt, be found to have its limitations, and further research is required before its value and scope can be definitely determined.

**Leukocytosis in Gonorrhea.**—Wile<sup>8</sup> has studied the question of leukocytosis in cases of gonorrhea. Fifty cases were employed, including men, women, and children suffering from various lesions. Wile concludes that gonorrhea presents no typical blood-picture, but varies with the individual case, the stage of the disease, and the variety of the lesion. In his series there was a slight decrease in the polynuclear neutrophils, while the mononuclear were slightly increased.

**The Gonococcus and Mixed Infection.**—Finger, Zweifel, Krönig, and Jadassohn<sup>9</sup> state that genital complications of gonorrhea are caused by the gonococcus alone, but that metastatic complications, like glandular involvements, arthritis, cardiac lesions, and skin abscesses, are usually caused by a mixed infection. Menge<sup>10</sup> believes that mixed infections in the female play a very unimportant rôle, and that true mixed infections seldom occur. He further states that in gonorrhea in the female complications by continuity and by metastasis are caused by the gonococcus of Neisser alone, but that other organisms have often been found, these being, however, due to secondary

<sup>1</sup> Sakaguchi, Y.: *Dermat. Wochenschr.*, Leipzig and Hamburg, 1912, vol. liv, p. 719.

<sup>2</sup> Sternberg, A. J.: *Gyn. Rundschau*, 1912.

<sup>3</sup> Eising, E. H.: *Med. Record*, June 1, 1912, p. 1038.

<sup>4</sup> Slingenberg, B.: *Arch. f. Gyn.*, Berlin, 1912, vol. xcvi, No. 2.

<sup>5</sup> von de Velde, T. H.: *Monats. f. Geburt. u. Gyn.*, Berlin, April, 1912, vol. xxxv, No. 4.

<sup>6</sup> Recio, A.: *Rivista di Medicina y Cirurgia*, Havana, April 25, 1912.

<sup>7</sup> London, J.: *Amer. Med.*, April, 1912.

<sup>8</sup> Wile, J. S.: *Amer. Jour. Med. Sci.*, new series, 1906, vol. cxxxi, p. 1052.

<sup>9</sup> Finger, Zweifel, Krönig, Jadassohn: Quoted by K. Menge: *Handbuch der Geschlechtskrankheiten*, Vienna, 1910.

<sup>10</sup> Menge: *Handbuch d. Geschlechtskrankheiten*, Vienna, 1910.

infections—as, for instance, a pyosalpinx in which mixed infection with the *Bacillus coli commune*, the latter organism having entered the tube secondarily from the intestinal tract. Certainly in acute cases pure cultures of gonococcus are much more likely to be obtained than in chronic cases. The locality invaded is of importance in this connection, as obviously some structures are more prone to a secondary infection with another microorganism than are others. Thus in gonorrheal proctitis the infection is always a mixed one, and the same is probably true of the oral cavity. This question of mixed infection of the various organs will be dealt with more fully in subsequent chapters. It is sufficient to state here that, in the author's opinion, mixed or rather secondary infections are by no means infrequent, especially in chronic cases, and when employing vaccine therapy this fact must be borne in mind.

CHIEF CHARACTERISTICS OF SIX GRAM-NEGATIVE COCCI<sup>1</sup>

ORGANISM AND SOURCE	GROWTH ON NUTROSE ACETIC AGAR AT 37° C.	GROWTH ON GELATIN AT 20° C.	PATHOGENICITY	ACTION ON CARBOHYDRATES + = acid - = alkaline 0 = no reaction			
				Glucose	Galactose	Maltose	Saccharose
<i>M. catarrhalis</i> , nasal and pharyngeal discharge.	Opaque; granular.	Positive. (Grows on ordinary agar at 37° C.)	Mice and guinea-pigs by intraperitoneal inoculations only.	—	—	—	—
<i>M. intracellu-laris</i> (meningococcus), cerebrospinal meningitis.	Clear; smooth.	Negative.	In some cases mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	—
<i>M. gonorrhoea</i> (gonococcus), urethral discharge.	No growth unless blood added.	Negative.	In some cases mice and guinea-pigs by intraperitoneal inoculations.	+	+	0	0
From nasal discharge from Hartford's case of influenza-like epidemic.	Clear, smooth, and becomes yellowish.	Negative at first, later positive. (Grows on ordinary agar at 37° C.)	Mice and guinea-pigs by intraperitoneal inoculations.	+	—	+	—
From nasal discharge from Hartford's case of influenza-like epidemic.	Opaque; granular.	Negative.	Mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	+
From urethra.	Opaque; somewhat granular; smooth edges.	Negative.	Mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	+
<i>M. melitensis</i> Malta fever.	Creamy and slightly yellowish.	Positive.	Monkeys, also rabbits and guinea-pigs, by intracerebral inoculation.	—	0	0	0

<sup>1</sup> From Dunn and Gordon, Brit. Med. Jour., 1905, vol. ii, p. 427.

### CHAPTER III

#### PATHOLOGIC CHANGES PRODUCED BY THE GONOCOCCUS IN THE FEMALE GENITAL TRACT

IN no disease, perhaps, is a more thorough knowledge of pathology necessary for an intelligent comprehension and study of the symptoms and treatment than in gonorrhea. It is the author's belief that the pathology, symptomatology, and treatment of any given disease should be studied coincidentally, for only in this way can the three branches be satisfactorily understood. In order for the clinician and the pathologist to reap the greatest benefit from their labor, the laboratory and the clinic should be closely associated. Given a thorough knowledge of the pathology, the symptoms resulting from the pathologic changes can be more or less closely worked out. For example, the symptoms and recurrent character of Bartholin's abscess are entirely explained by a study of the histology and anatomy of the gland. The same may be said, in a somewhat broader sense, of those numerous and varied lesions generally classified under the heading of Pelvic Inflammatory Disease. The patulous tube, with its leakage of infected material, is productive of active pelvic peritonitis, with its accompanying symptoms; the closed tube, with its perhaps more massive pathology, and its often less marked subjective symptomatology; the sterility due to endometritis or the occlusion of the tube or interference with the maturation and rupture of the Graafian follicle; the adhesions to the bladder or rectum, with their accompanying dysuria or rectal symptoms, are also thus explained. So almost the entire category of symptoms may be elucidated by a study of the pathology of the individual case. A correlation of the pathology and the symptomatology is, therefore, of the greatest advantage. In the same way a knowledge of the pathology is of great aid in selecting the best form of treatment.

In previous pages an attempt has been made to depict the method of invasion of the gonococcus to the genital tract of the female and the type of lesions produced. The infection almost invariably begins as a surface inflammation, and spreads thence more or less deeply into the underlying structures. The gonococcus may lie dormant, especially in areas below the internal os, for a prolonged period, but if

the proper stimulus is applied, it is ready to spring into activity. On the other hand, protracted encapsulation, such as frequently occurs in the adnexa, tends to destroy the organism. In the latter location the prolongation of symptoms may be traced to three definite causes: reinfection, either autoinfection, from the cervix and endometrium, or from without, may occur; or secondary infection may result and the lesions be actively continued by organisms other than the gonococcus; and, lastly, the scar tissue or adhesions resulting from the active infection may persist and produce symptoms.

Many more or less indirect results of gonorrhea also occur. Thus the gonococcus is believed to prepare the soil for subsequent infections, such as tuberculosis, or for the pyogenic organism; tubal carcinoma seldom occurs in previously normal tubes, whereas the loss of cilia in the tubal epithelium and kinks of the tube resulting from adhesions are known to be strong predisposing factors of tubal pregnancy.

In localities invested by adult squamous epithelium, such as the vagina, the gonococcus rarely produces serious lesions, the inflammation being usually due to the irritating toxin-laden discharge constantly passing over the surface. It is true that gonococci may occasionally be found in the depth of and among the cells of the squamous epithelium, but the organisms do not appear to thrive in these areas. On true mucosa, however, a different condition exists: the surface epithelium becomes swollen, and the cells become separated from one another by the inflammatory exudate. Many of the cells are desquamated, and are ultimately replaced by a modified epithelium—in some instances non-ciliated columnar, and in others even by squamous, epithelium; or cicatricial tissue may result. The gonococci quickly gain access to the glands, in which similar changes occur in the investing cells. As a result, periglandular inflammation is usually a marked feature. In some instances the gland-openings become occluded and finally become filled with inflammatory exudate, resulting in the formation of the pseudo-abscesses of Jadassohn. As the process advances, the epithelium and its basement-membrane may be entirely destroyed, and a true abscess, surrounded by a pyogenic membrane, may occur. This condition is not infrequently seen on the vulvovaginal gland, or the deeper epithelium of the gland may escape or be but temporarily involved, and, as a result, occlusion cysts are found. A similar pathology may occur in the cervix, and to a less marked extent in the corporeal endometrium or the mucosa of the tube. The gonococci in the glands may persist long after a surface cure has been obtained, or may from this location tend to aggravate the surface inflammation by reinfection. This tendency to glandular penetration possessed by the

gonococcus is of importance in considering the treatment of the disease, and, to a large extent, accounts for the resistance to gonococciads as ordinarily applied to the surface mucosa.

From the surface and glands the gonococcus escapes to the stroma of the mucosa, and thence to the underlying muscular layer, or even, in severe cases, to the serosa or adjacent structures. As a result, the stroma of the mucosa and the underlying tissue become swollen and infiltrated with inflammatory products and the blood-vessels become congested. These changes vary with the stage, severity of the disease, and the area attacked. As a result of desquamation of the surface epithelium or long-continued inflammation in the depths of the mucosa or underlying tissues, cicatrices may be formed, and by their contractile properties produce pathologic changes and a continuance of symptoms long after all signs of active inflammation have subsided. This fact is of especial importance when considering the symptomatology and treatment of intraperitoneal pelvic lesions. By this process an extensive pathology may be greatly curtailed, and result in "the derelicts of the gonococcal storm," as they have been aptly termed by Sanger. There is no doubt that but for this tendency toward the formation of scar tissue, the proportion of cases of pelvic inflammatory disease ultimately requiring operative intervention after properly carried out palliative treatment would be greatly reduced. In other words, many old, chronic cases suffer more markedly from adhesions and contractions than from the actual infection. This, of course, does not apply to those cases—and they are many—that exhibit more or less frequent or prolonged exacerbations.

From the method of invasion, the most marked pathologic change is usually found near the surface. The tissue in this locality seldom undergoes complete resolution, evidences of past disturbances nearly always remaining. The chief characteristic of gonococcal inflammation is its chronicity. The much mooted question, as to whether or not the gonococcus produces lesions sufficiently characteristic to differentiate them from other forms of infection, without a study of the bacteriology of the individual case, will be more thoroughly discussed in subsequent pages.

#### GONORRHEAL VULVITIS

Vulvitis in the adult is a not infrequent accompaniment of gonorrhea of the cervix or urethra. In infants and young children the infection usually spreads to the vagina, producing a vulvovaginitis. In the young, on account of the delicacy of the skin over the affected areas, the lesions are likely to be more pronounced. Gonorrhea may

produce the most severe grade of vulvitis. During the acute stage the labia majora and minora, the clitoris, and the adjacent structures are reddened, swollen, and tender. The affected area is bathed in a more or less profuse purulent discharge, which contains numerous gonococci. The chronic vulvitis, which often continues after the acute process has subsided, is characterized by similar symptoms, all of which are, however, less pronounced. Although some redness usually persists, the edema and swelling are, as a rule, less marked, and tenderness is either absent or greatly decreased. The discharge is yellowish or brownish in color, thick, but less profuse, and contains fewer gonococci than during the acute stage. In neglected or careless patients yellowish or brownish crusts may form, and in severe cases, when these are removed, bleeding ulcers may be found beneath. Evidences of Bartholinitis and of urethritis can generally be found. Condylomata are not infrequent, especially in neglected cases or when pregnancy is present.

**Histology.**—The histology resembles that of an ordinary dermatitis, and varies in acuteness and extent of involvement according to the individual case and the stage of the infection.

#### INFLAMMATORY LESIONS OF BARTHOLIN'S GLAND

Bartholin's glands (named after Bartholinus,<sup>1</sup> who described these structures in detail in the seventeenth century) are structures usually about 3 to 5 cm. in length, and having a diameter of 2 to 4 mm. The ducts vary somewhat in length, but average about 1.5 cm., and at the outlet have a diameter of about 0.5 mm., but widen as the gland is approached. In their widest portion they have a diameter of about 2 or 2.5 mm. Before reaching the gland the duct divides into two or three trunks, which in turn subdivide so that finally each lobule of the gland is drained by a small duct. The gland and its ducts have been appropriately likened to a bunch of grapes somewhat more developed on one side than on the other, the duct representing the stem, and the lobules, the grapes. The outer part of the duct is lined by multiple layers of squamous epithelium. In the deeper portions transitional epithelium is present. The small ducts which finally enter the gland present a somewhat varying histologic picture: in some instances they are lined by transitional epithelium; in others, by cylindric or cuboid cells. On cross-section the glands are found to be round or oval, and are invested by a single layer of high cylindric epithelium. These cells often contain large quantities of mucus, and under these conditions are of the goblet type, and are not dissimilar to the glandular elements of the cervix, except that the protoplasm does

<sup>1</sup> Huguier: *Mémoires de l'Académie de Médecine*, Paris, 1856, vol. xv, p. 531.



not take the hematoxylin stain. The glands are tubular or racemose, and are contained in a thick framework of connective tissue and non-striped muscle. The glands and adjacent tissue are rich in blood-vessels.

Bartholinitis may occur independently, or as an accompaniment of vulvitis. Although theoretically cysts and other manifestations of bartholinitis may be the result of various forms of infection, if carefully studied, the great majority of cases can be traced to gonorrhea. Of 14 specimens of cysts and 21 specimens of abscesses of this structure in the Gynecological Laboratory of the University of Pennsylvania, all were clinically associated with gonorrhea. Veit<sup>1</sup> believes that bartholinitis is nearly always of gonorrheal origin. Suppurative processes are, however, frequently due to mixed infection. As a result of gonorrheal infection of Bartholin's gland, various lesions may be produced. More or less well-marked redness and swelling, often somewhat resembling a mosquito-bite,—the so-called gonococcal maculae of Sanger,—are present about the exit of the gland whenever the structure becomes inflamed. The gonococcal maculae persist for prolonged periods, even after lengthy intervals of quiescence of the disease.

**Cyst.**—In 1861 Breton<sup>2</sup> described cysts of Bartholin's gland, this being, perhaps, the earliest description of these lesions. If the inflammation is limited to the duct of the gland, partial or entire occlusion of this structure may result, and be followed by the formation of a retention cyst. Cysts of Bartholin's gland may occur in the duct or in the gland, or both structures may be involved, depending upon the situation of the occlusion. The tumors may be unilateral or bilateral, the former being the more common. Cysts due to occlusion of the orifice of the duct are of the most frequent variety, and are always unilocular. These tumors are pyriform in shape, the large end being directed downward. While *in situ*, if the tumor is of moderate or large size, the vulvar cleft is distorted. These cysts are usually about the size of a pigeon's egg, and, as a rule, grow slowly, although rapid increase in size is sometimes noted. This may in some instances be due to hemorrhage occurring in the cavity of the cyst. When a cyst of the duct is present, the gland is pushed upward and outward. Cysts of the gland proper are, as a rule, more spheric, more deeply placed than cysts of the duct, and show a tendency to extend into the rectovaginal septum. Cysts that occur in the gland or in the depths of the duct where it has subdivided may be multiple. Cullen<sup>3</sup> reported a series of 17 cysts of Bartholin's gland. The smallest of these was

<sup>1</sup> Veit: Handbuch der Gynäkologie.

<sup>2</sup> Breton: Thèse de Strashourg, 1861.

<sup>3</sup> Cullen, T. C.: Jour. Amer. Med. Assoc., January 21, 1905, p. 204.

5 mm. in diameter, and the largest, 4 cm. Kleinwächter<sup>1</sup> asserts that retention cysts of this locality are rarely larger than a hen's egg. In the author's series of 14 cases, the largest was 8 cm. in diameter, and all were unilateral. Small cysts produce no subjective symptoms, and patients are frequently not aware of their presence. They are, however, not infrequently observed during the routine gynecologic examination, and are quite often discovered accidentally while performing plastic operations on the perineum. Wiener<sup>2</sup> has reported the history of an unusual case in which the cysts were bilateral and measured respectively 11 x 8 and 12 x 5 cm. An unusually large specimen of this form of growth has recently been described by Dartigues.<sup>3</sup> If removed without rupture or when examined *in situ*, the cysts are moderately tense and fluctuant. After removal the outer surface is roughened at the point where the tumors have been shelled out or dissected free from their bed of adhesions. On section, the walls are found to vary quite markedly in thickness in different specimens and in different parts of the same specimen. The walls are, as a rule, moderately dense. The lining is generally smooth, although some circular or crescent-shaped openings are often present, indicating dilated gland openings. The cysts are usually unilocular, although occasionally two or more cavities are present, this point depending upon the location of the occlusion. The cyst contents generally consist of clear serous fluid, but they may be of a chocolate color, owing to the admixture of blood. As a result of infection, the contents are sometimes turbid or purulent.

*Histology.*—The microscopic picture varies quite widely in different specimens. As a rule, areas of comparatively normal gland are present. The cyst lining differs according to the point of origin of the cyst. If the cyst is due to the occlusion of the main duct near the outlet, the investing epithelium will naturally be largely squamous in type, whereas if the occlusion has been in one of the secondary ducts, the lining epithelium may be transitional or cylindric. Not infrequently all varieties of cells are present in different portions of the cyst. In large cysts, in those of long standing, or in those in which marked intracystic tension has been present, the investing epithelium is flattened or may be largely absent. The walls of the cysts are rich in blood-vessels, and are composed of unstriped muscle and fibrous connective tissue. Only rarely can gonococci be recovered from the contents of the cyst, for prolonged encapsulation tends to destroy this organism.

<sup>1</sup> Kleinwächter: Zeit. f. Geb. u. Gyn., vol. xxxii, p. 191.

<sup>2</sup> Wiener, S.: Amer. Jour. Obst., February, 1912, p. 243.

<sup>3</sup> Dartigues: Paris Chirurg., 1911, vol. iii, p. 565.



**Bartholinitis.**—If occlusion does not occur in the duct, and the infection extends to the gland, inflammatory changes are here set up. The gland becomes enlarged, infiltrated with inflammatory products, and presents the usual clinical and pathologic characteristics of adenitis. This stage may become chronic, with the formation of more or less connective tissue, so that the gland is easily palpable while *in situ* as a firm, oblong, flattened body.

**Abscess of Bartholin's Gland.**—Not infrequently, however, the inflammation advances to pus formation, and a Bartholin's abscess results. When this occurs, only rarely is the entire gland equally involved. As a rule, one or more lobules are affected, and when the abscess ruptures or is incised, healing tends to occur without eradication of the infection, so that at a subsequent date, often as the result of slight trauma or of reinfection with virulent microorganisms, or sometimes for no apparent reason, suppuration develops in other lobules. The history of a number of abscesses occurring in this locality and extending sometimes over a considerable period of time is pathognomonic of this condition, and is due to suppuration first of one lobule and then of another. The entire gland must be removed if a permanent cure is to be effected. Macroscopically, the abscesses appear as small, ovoid or round, purulent collections, rarely larger than a bantam's egg, and more often about the size of an English walnut. The abscesses are situated rather deeply, and involve the lower portion of the labia, extending backward toward the perineum. Sometimes there is considerable swelling and induration surrounding the abscess, whereas at other times there is comparatively little. In some cases pus may be squeezed out of the duct. The walls are, as a rule, thick, and the lining not infrequently presents a septate appearance. The contents consist of moderately thick, yellowish or greenish pus, which is often blood stained.

**Histology.**—The gland and the surrounding tissue are infiltrated with acute or subacute inflammatory products. The epithelium of the gland presents the usual inflammatory changes. The blood-vessels are engorged, and frequently the inflammatory changes are found following along the course of the lymphatics. The pus in these abscesses contains gonococci, and not infrequently other microorganisms are present; indeed, some writers assert that mixed infection is always present in suppurative processes of this locality.

#### CONDYLOMATA ACUMINATA

Condylomata acuminata, or venereal warts, of gonorrheal origin, are the result of irritation produced by the more or less constant

bathing of the parts with the leukorrheal discharge. They are papillary outgrowths that appear on the external genitalia and occasionally on the vagina or cervix. The tumors may spring from the perineum, labia majora or minora, or other adjacent structures. The growths vary in size from those of microscopic dimensions to those the size of a man's fist or larger. The history of an unusually extensive case has recently been reported by Rassegna.<sup>1</sup> Multiple growths are the rule, and tumors of various sizes are usually present in the same case. The tumors are composed of localized hypertrophies of the outer layers of the skin, and are whitish, pinkish, or purplish, wart-like, cauliflower-shaped masses, sometimes distinctly pedunculated, and in other instances springing from a broad base. The tumors originate as discrete outgrowths, but frequently they coalesce. The surface of the tumors and the surrounding skin are bathed by a thin, irritating, offensive discharge. Condylomata acuminata of gonorrheal origin usually possess a distinctly pointed apex, in contradistinction to syphilitic condylomata, which are flattened, and only rarely tend to become pedunculated. Gonorrheal condylomata acuminata, when situated within the vagina, are often flattened as a result of pressure, and frequently present a somewhat macerated appearance. As a result of the irritating discharge, the cutaneous surface surrounding the excrescences is often reddened.

*Histology.*—The tumors are composed of hypertrophies of the outer layers of the skin, the papillæ forming the chief constituents of the growths. They are moderately well supplied with blood-vessels, and upon their vascularity and the thinness of the outer layers of epithelium depend, to a large extent, their color and the amount of discharge they produce. The connective tissue surrounding the tumors generally presents a moderate degree of chronic inflammatory reaction.

#### VAGINITIS

The vagina is lined by a modified skin and normally contains but few glands. Cullen, v. Preuschen, Hennig, and others have demonstrated conclusively the presence of glands in the vaginal lining, and have also proved their relative scarcity. In the young the outer layer of the stratified squamous epithelium is ill developed, and this fact accounts, to a large extent, for the frequency of acute vaginitis in children. As puberty is approached the epithelial layer becomes thicker and more dense and an attempt is made toward the formation of an outer horny layer, such as is found in the skin proper, and, as a result, acute vaginitis during active sexual life is infrequent. At the

<sup>1</sup> Rassegna: Jour. d'obst. e ginec., Naples, 1911, vol. xx, 217.

menopause atrophic changes occur, and doubtless partially explain the greater susceptibility of the vagina to infection at this time.

During the acute stage the vaginal lining is reddened, swollen, edematous, and bathed in a creamy, yellowish, purulent discharge, which may be blood-streaked. The normal acid reaction of the vaginal secretion is diminished or may even be alkaline. In the chronic stage, especially in the young, the vaginal mucosa presents a granular appearance, due to localization of the inflammation to various groups of papillæ. Ulcers or small excoriations are not infrequent, and when of gonorrheal origin, are often present in the vaginal vault. Gonorrheal vaginitis cannot with certainty be distinguished by the macroscopic appearance from other forms of inflammation. In long-continued cases vaginitis condylomatosa may be present. The growths are much less frequent, of smaller size, and are more discretely distributed than when occurring on the external genitalia.

*Histology.*—The various layers of the vaginal mucosa are swollen and infiltrated with inflammatory products. In chronic cases the inflammation often shows a tendency to localize in certain groups of papillæ in the subepithelial tissue. In some instances the epithelium may desquamate, producing small ulcers that may extend to the underlying connective tissue. Immediately beneath the layer of stratified squamous epithelium is usually found a well-defined zone of inflammatory reaction, characterized by an infiltration of small round-cells, polymorphonuclear leukocytes, serum, and congested capillaries. Small round-cells and polymorphonuclear leukocytes are also often present in the protective epithelium.

#### URETHRITIS

The infection originates at or just within the external urinary meatus. During the acute stage the mucosa of the external meatus is swollen and reddened, and may be found protruding a short distance from the urethra. Further examination reveals the fact that the mucosa of the canal is inflamed. Milking the urethra produces a considerable quantity of creamy yellowish pus, which contains typical gonococci in large numbers. The urethra itself is tender, and may be felt as a more or less indurated band lying beneath the vaginal mucosa. As the disease becomes chronic the discharge diminishes, becomes milky or mucopurulent in character, and in some cases disappears almost entirely. The gonococci are fewer in number, and under ordinary circumstances it may be impossible to obtain typical microorganisms. The mucosa of the urethra may be slightly thickened or may appear normal. Skene's and Schüller's glands are, however,

nearly always reddened and prominent, and upon pressure a small amount of pus can usually be extruded. The urethra at this stage may feel normal to the examining finger, or a certain amount of peri-urethral infiltration may be present. The latter is generally the case in long-standing chronic cases. Abscesses may form in Skene's, Schüller's, or in any of the mucous glands of the urethra in either the acute or the chronic stage. The abscesses are usually on the floor of the anterior portion of the urethra, and tend to bulge into the vagina. More or less complete evacuation of the contents of the abscess into the urethra can often be accomplished by pressure through the vagina. As a result of long-standing inflammation the mucous glands sometimes become obliterated, and under such circumstances these structures can often be felt immediately beneath the urethra as hard, indurated bodies. A caruncle may develop.

*Histology.*—Specimens of urethritis are rarely seen in the laboratory, but when observed, are found to present the usual evidences of inflammation, the histologic picture varying according to the portion of the urethra examined and the stage of the disease. The inflammatory changes are most persistent in the glands in the anterior portion of the floor of the urethra.

### CERVICITIS

Gonorrheal infection of the cervix is extremely frequent, and, according to Menge,<sup>1</sup> is found in about 80 per cent. of all acute and in 95 per cent. of all chronic cases. The gonococcus exhibits a marked predilection for columnar epithelium, and a comparative protective influence is exerted by squamous epithelium, especially the fully developed squamous epithelium of the adult. The portio vaginalis is normally covered by multiple layers of stratified squamous epithelium, and is, therefore, rarely if ever primarily involved. Anatomic research has demonstrated the fact that the squamous epithelium usually extends upward in the cervical canal to about the external os. Cullen,<sup>2</sup> Ruge,<sup>3</sup> and others have shown that this is a variable point. In some cases the squamous epithelium extends upward nearly to or even above the internal os, whereas in other cases the point of junction of the two types of epithelium is considerably outside the external os. From the vaginal wall to the external os the squamous epithelium gradually thins out until, at the point of junction with the cylindric epi-

<sup>1</sup> Menge, K.: *Handbuch der Geschlechtsk.*, Vienna, 1910.

<sup>2</sup> Cullen, T. S.: *Cancer of the Uterus*, 1900, p. 17.

<sup>3</sup> Winter, G., and Ruge, C.: *A Text-book of Gynecological Diagnosis*. Translated after third revised edition, Philadelphia and London.



FIG. 2.—ENDOCERVICITIS.

The section has been taken through the mucosa of the cervical canal. The surface epithelium is, for the most part, desquamated. The superficial layers of the mucosa are infiltrated with an inflammatory exudate. In the deeper portions of the glands the epithelium is somewhat degenerated, and a well-defined periglandular inflammation is present. The pathologic changes are, however, most marked near the surface ( $\times 50$ ).



thelium, it is, as a rule, not more than half as thick as at the vaginocervical junction. In some cases the cylindric epithelium is of a slightly papillary character, and extends outward over the portio—the so-called congenital erosion. Theoretically, therefore, women in whom the squamous epithelium is thin; those in whom the squamous epithelium extends only to the external os; and those in whom the so-called congenital erosions are present, should be more susceptible to gonorrheal cervicitis than those in whom the squamous epithelium is thick, and in whom it extends deeply into the cervical canal. Gonorrheal infection tends to localize itself in the true mucosa of the cervical canal, and if extension upward occurs, this takes place at a menstrual period, or during or immediately subsequent to the emptying of a pregnant uterus. In other words, in the great majority of cases the infection originates as an endocervicitis, the chief symptom of which is a cervical leukorrhea produced by a hypersecretion of the cervical glands incident to the inflammation. As a result of swelling and hyperemia of the mucosa of the canal, not infrequently a portion of this will project beyond the external os, and in chronic or severe cases the inflammation itself may involve the adjacent squamous epithelium of the portio, so that on examination the external os appears as a bright-red spot surrounded by an infiltrated, granular area of more or less limited extent, and bathed in an abundant thick mucus or mucopurulent discharge. Gottschalk<sup>1</sup> explains the presence of cylindric epithelium in the portio—the so-called “erosion” due to gonorrhea—by stating that the glands found in these inflammatory processes are true ectopic cervical glands. The normal stratified squamous epithelium of the portio is pushed away by extravasated blood, by a copious infiltration of small round-cells, and sometimes by the rupture of an underlying retention cyst. The denuded surface of the portio becomes rapidly covered by the mucosa from the canal, and by ectopic cervical gland epithelium from glands that open upon the denuded area. In some instances newly formed stratified squamous epithelium is pushed off by an extension of the mucosa of the canal. Naturally, the picture varies quite markedly in different individuals and in the nulliparous and the multiparous. Retention cysts, formed from the cervical glands and varying in size from a few millimeters in diameter to the size of a pea or even larger, are often present. True macroscopic erosions of gonorrheal origin are extremely rare.

*Histology.*—The chronicity of gonorrheal cervicitis can be entirely explained by a study of the histology of this organ. In the sexually mature individual the cervical canal is lined by high cylindric epithe-

<sup>1</sup> Gottschalk, S.: Brit. Med. Jour., October 22, 1910.



lium, a type of tissue peculiarly susceptible to gonorrhea. The secretion of the canal is weakly alkaline in reaction. The walls of the canal are irregular, and for the most part are composed of heaped-up mucosa, known as the *arbor vitæ* and the *plicæ palmatæ*. The mucosa itself contains numerous mucous glands, which vary from small crypts to those suggesting the racemose type. The entrance to many of even the large glands is very small (the flask-like glands), whereas others are tubular in character or undergo repeated branching—all points that favor the continuance of the infection. The cervical glands are the lurking-place of the gonococcus, and, owing to their nature, offer peculiar protection against the ordinary forms of treatment. As the result of gonorrhea, the entire mucosa becomes edematous, infiltrated with inflammatory products, and the openings of the glands become even more contracted. As the infection becomes subacute or chronic, the stroma of the mucosa in many areas assumes more or less its normal appearance, the inflammation usually persisting as a periglandular reaction, characterized by an infiltration of small round-cells. Not infrequently a narrow zone of small round-cells, occasionally leukocytes, free blood, serum, and engorged or newly formed vessels, is present immediately beneath the squamous epithelium about the external os. As a result of inflammation some of the gland-openings become occluded, and small retention cysts (ovula Nabothi) occur. These are lined by cylindric epithelium, which in many cases, owing to intraglandular pressure, is greatly flattened. The cylindric epithelium of the canal not infrequently shows metaplastic changes, and even areas of reduplicated layers of more or less typical squamous epithelium may be observed. Metaplasia of the surface epithelium is more frequent than that of the glandular. A certain amount of cervical hypertrophy usually results from long-standing inflammation. The inflammation is, as a rule, moderately superficial.

#### CORPOREAL ENDOMETRITIS AND METRITIS

These conditions invariably result from an endocervicitis. The extension from the mucosa of the cervix to that of the body of the uterus occurs with but few exceptions either at a menstrual period or shortly following the emptying of a pregnant uterus. While gonorrheal endocervicitis tends to become chronic and exhibits little or no disposition to spontaneous cure, gonorrhea of the corporeal endometrium in many cases does go on to resolution. This may possibly be accounted for by the excellent blood-supply and drainage of this locality. Not infrequently an active inflammation of the endometrium is kept up by a constant reinfection from the leaking uterine end of a pyosal-



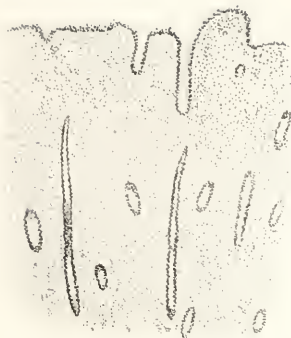


FIG. 3.—ENDOMETRIUM DURING THE POSTMENSTRUAL PERIOD.

The glands run a straight course, perpendicular to the surface. The lumen of each gland is extremely narrow and empty (C. C. Norris and F. E. Keene, *Surg., Gyn., and Obst.*, January, 1909, pp. 44-54).

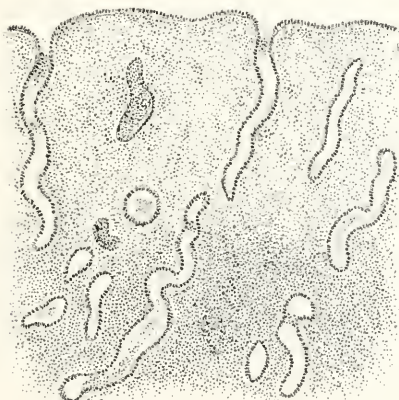


FIG. 4.—ENDOMETRIUM DURING THE INTERVAL.

The upper portion of the stroma shows edema. The lumina of the glands are distinctly wider than in the preceding stage, and have assumed the corkscrew shape. Some of the glands contain a thready substance, taking the eosin stain (C. C. Norris and F. E. Keene, *Surg., Gyn., and Obst.*, January, 1909, pp. 44-54).



FIG. 5.—ENDOMETRIUM DURING THE PREMENSTRUAL STAGE.

The superficial compact and deep spongy layers are easily recognized. The glands are irregular in shape and their lumina are still wider than those of the interval. Many of the glands contain mucus (C. C. Norris and F. E. Keene, *Surg., Gyn., and Obst.*, January, 1909, pp. 44-54).

pinx. Indeed, well-marked cases of chronic corporeal endometritis are comparatively seldom observed, except in conjunction with tubal infection or abortion, and even in the presence of well-marked adnexal lesions the endometrium is often comparatively normal. Prior to the researches of Adler and Hitschmann,<sup>1</sup> which were subsequently confirmed by the work of Keene and the author,<sup>2</sup> as well as by other observers, many of the physiologic changes incident to the normal menstrual cycle were viewed as pathologic, and, as a result, endometritis was frequently diagnosed when no inflammatory change of any sort existed. Furthermore, the classification of endometritis was greatly complicated by such qualifying terms as glandular, interstitial, polypoid, fungoid, etc., which were in many instances, at least, merely phases of the menstrual cycle. Thus, if the endometrium to be examined has been removed a few days prior to menstruation, the glands would naturally be large and prominent, and a glandular endometritis would be diagnosed, whereas if the tissue chanced to be examined in the postmenstrual period, it was often thought to be the seat of an interstitial inflammation.

Albrecht<sup>3</sup> divides endometritis into three forms—acute, chronic, and specific (syphilitic and tubercular). The author has found this classification entirely satisfactory. This question is not, however, entirely settled. Hitschmann and Adler<sup>4</sup> believe that there may be a glandular hyperplasia, but that it has nothing to do with inflammation, and that the term “endometritis glandularis hyperplastica” is a misnomer. They assert that, even in the early stages of inflammation, a diagnosis of endometritis is justifiable only when the plasma cell is present. Buttner<sup>5</sup> considers the plasma cell a certain criterion of inflammation and that nothing else is so positive. He, however, believes an abundant infiltration of leukocytes may be accorded considerable importance. Mittelmann,<sup>6</sup> while conducting a research suggested by Veit, came to the conclusion that there may be an acute or a subacute endometritis in which no plasma cells are present, but that in chronic endometritis these cells can always be observed. This observer concludes that the diagnosis of endometritis depends upon the microscopic finding, and cannot be made from the clinical symptoms. Other authors claim that the presence or absence of the plasma

<sup>1</sup> Adler and Hitschmann: *Monats. f. Geb. u. Gyn.*, vol. xxvii, No. 1.

<sup>2</sup> Norris, C. C., and Keene, F. E.: *Surg., Gyn., and Obst.*, January, 1909, p. 44.

<sup>3</sup> Albrecht: *Monats. f. Geb. u. Gyn.*, 1911, vol. xxxiv, p. 397.

<sup>4</sup> Hitschmann and Adler: *Münch. med. Woch.*, 1909, No. 41, p. 2130.

<sup>5</sup> Buttner: *Münch. med. Woch.*, 1909, No. 30, p. 1652.

<sup>6</sup> Mittelmann, C.: *Münch. med. Woch.*, 1910, No. 14, p. 763.

cell is of little significance. Albrecht<sup>1</sup> declares that in the examination of 130 specimens of curetings and the endometrium of 15 cases in which the uterus had been removed, in only 5 per cent. were plasma cells found.

It is certain that the physiologic changes incident to menstruation continue, sometimes more or less modified, in cases of endometritis. It is also certain that some cases of endometritis exhibit a tendency toward the so-called glandular form, whereas in others the glands are contracted and the stroma is condensed entirely apart from the changes incident to menstruation. These facts, while admitted by Mittelmann,<sup>2</sup> are explained by her on the ground of a preëxisting hyperplasia or atrophy. Ellerbroeck,<sup>3</sup> however, after examining the endometrium of 110 cases of actual endometritis, in all of which the acute attack had subsided prior to the removal of the endometrium, concludes that Hirschmann and Adler are in error when they deny absolutely the existence of a glandular form of endometritis. Frank<sup>4</sup> also states that glandular hypertrophy and hyperplasia may be due to inflammation, as well as to ovarian influence. The author's experience is that glandular, and more particularly interstitial, changes of sufficiently pronounced characteristics to warrant a diagnosis do occur as the result of inflammation, and that while it has nearly always been possible to demonstrate the plasma cell in both acute and chronic cases, he considers it of great diagnostic value, but is of the opinion that its presence is not essential for the diagnosis of endometritis. While the presence or absence of the plasma cell is a valuable aid to the diagnosis of endometritis, the entire question should not, however, rest upon this point. To demonstrate the presence of plasma cells certain special fixing and staining reagents are necessary. As a further proof that the glandular and interstitial changes are not entirely dependent upon the menstrual cycle, it may be stated that it is no uncommon experience to find, in the same endometrium, some areas presenting pronounced glandular hypertrophies, whereas in others atrophic or interstitial changes may be observed. However, in many cases no inflammatory glandular changes are present, and, indeed, only rarely are these sufficiently well marked to merit the term glandular or interstitial endometritis. This is an additional argument against the employment of the terms glandular, interstitial, polypoid, etc., when referring to inflammations of the endometrium.

<sup>1</sup> Albrecht, H.: Münch. med. Woch., 1910, No. 23, p. 1260.

<sup>2</sup> Mittelmann, C.: Münch. med. Woch., 1910, No. 14, p. 763.

<sup>3</sup> Ellerbroeck: Zentralbl. f. Gyn., 1909, vol. xxxiii, p. 682.

<sup>4</sup> Frank, R. T.: Amer. Jour. Obst., February, 1912, p. 207.



FIG. 6.—THE DECIDUA OF INTRA-UTERINE PREGNANCY.

A, Compact layer; B, spongy layer; C, muscle (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909, pp. 44-54).



FIG. 7.—GLANDULAR EPITHELIUM DURING THE POSTMENSTRUAL STAGE.

The cells are low and narrow, and the nucleus occupies a large portion of the cell. The lumen of the gland is very narrow and completely empty (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909, pp. 44-54).



FIG. 8.—GLANDULAR EPITHELIUM DURING THE INTERVAL.

The cells have become higher and broader, and at A show an inner granular and outer homogeneous zone. The nuclei are well stained and are situated at the base of the cells. The lumen of the gland is dilated and contains a thready material (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909).

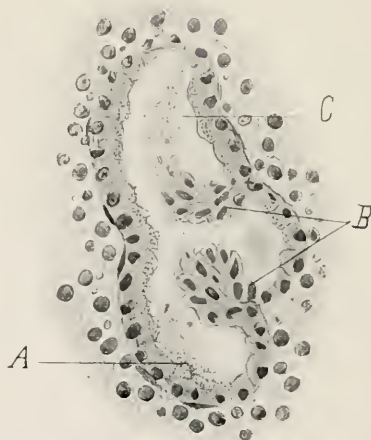


FIG. 9.—GLANDULAR EPITHELIUM DURING THE LATE PREMENSTRUAL STAGE.

The individual cells are indistinctly differentiated from one another. The cells have become much broader, and their inner contour irregular. In some areas (A) the inner aspect of the cells appears broken, with discharge of their contents into the lumen of the gland. At B there has been a proliferation of the cells; C, mucus (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909).

Since the plasma cell is now recognized not only as an indication of endometritis, but is by some authorities considered to be of much significance in the differential diagnosis between gonorrhea and other forms of infection, not only in the endometrium, but also in the adnexa, a more detailed description may not be out of order.

By Mallory's eosin-methylene-blue stain the lymphogenous cells may be demonstrated particularly well, and their identification, even with the low power, is easy. By Schridde's<sup>1</sup> method of osmic acid and acid fuchsin stain, certain granular elements in the protoplasm surrounding the nucleus can be beautifully shown, not only in the plasma cell, but also in the lymphocytes and lymphoblasts. Unna-Pappenheim's methyl-green stain also gives excellent results.

Schridde's method for staining cells is as follows:

1. Within a few minutes of removal place tissue in Orth's fluid, warmed to 35° C., and keep in the incubator at this temperature for twenty-four hours.
2. Müller's fluid at room temperature, twenty-four hours.
3. Running water, twenty-four hours.
4. Distilled water (many changes), six hours.
5. One per cent. aqueous solution of osmic acid, in the dark, twenty-four hours.
6. Place sections in ascending alcohols (70 per cent., 80 per cent., 95 per cent., and absolute), allowing them to remain in each for about twelve hours.
7. Chloroform (pure), four hours.
8. Equal parts of chloroform and paraffin (55° F.) over the oven, twelve hours.
9. Paraffin (50° to 55° F.) baths, in the oven (two changes), two hours each.
10. Embed (60 paraffin) and cool quickly in cold water.
11. Cut thin sections (1 to 2  $\mu$ ).

Staining is as follows:

1. Place sections in xylol (two changes), five minutes each.
2. Absolute alcohol, 95 per cent., and 80 per cent., three minutes each.
3. Wash in distilled water.
4. Stain in warmed anilin-water acid-fuchsin (acid-fuchsin, 20 grams; anilin-water, 100 c.c.) over night or from two to twenty-four hours.
5. Drain off and differentiate in the following solution:

Saturated alcoholic solution of pierie acid . . . . . 1 part  
 Twenty per cent. alcohol . . . . . 7 parts

until the section becomes a clear, yellowish-red color, which will take about thirty minutes or a little longer.

<sup>1</sup> Schridde: Münch. med. Woch., 1908, No. 20.



6. Dehydrate in 95 per cent. alcohol; then in absolute for a few seconds, clear in xylol and mount in xylol balsam.

Result: Neutrophilic granules, brownish red; eosinophilic, blackish red; plasma-cell granules, brick red; mast-cell granules, grayish black; basophilic granules, unstained, but easily distinguishable; brownish-red granules in the lymphocytes.

The plasma cell is about twice the size of a lymphoid cell, and possesses a comparatively large amount of basophilic protoplasm. The cell outline is usually polyhedral and generally irregular, and often shows a pale staining area surrounding the nucleus. The nucleus is moderate in size, and, owing to the large amount of chromatin present, stains deeply. It usually presents a circular or wheel-like appearance. Gurd<sup>1</sup> has drawn attention to the curious appearance of the nucleus observed in some sections; the appearance does not in the least resemble the typical "*Radkern*," but shows two narrow, crescent-shaped masses of chromatin upon each of the two sides of the nucleus, as if the chromatin had arranged itself entirely over the surface of the nucleus, leaving no meshwork of chromatin material within the latter's substance. The origin of the plasma cell is still somewhat in doubt. Unna<sup>2</sup> believed that the cell developed directly from fibrous tissue. Marchand<sup>3</sup> suggested that it might be derived from specially differentiated adventitia cells. Joannovics<sup>4</sup> asserts that he believes that the plasma cell is a derivative of the tissue lymphocyte, which, for the most part, is developed from adventitial elements. Marschalko<sup>5</sup> and Gurd<sup>6</sup> believe the cell to be developed from the lymphocyte of the blood or lymph, and this opinion is generally held by pathologists at the present day. Schridde<sup>7</sup> states that large numbers of Russel's bodies are always found among plasma cells. Gurd,<sup>8</sup> on the other hand, declares that in his preparations they were not more numerous than in general chronic inflammations. Miller<sup>9</sup> has carefully studied these structures, and concludes that true Russel's bodies develop only in plasma cells; that when they are extracellular, they are round, refractile, and stain an intense black with Weigert's stain, and that he believes them to be a myelin degeneration of the protoplasm of the

<sup>1</sup> Gurd, F. B.: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, p. 169.

<sup>2</sup> Unna: Plasmazellen, Enzyklopädie der mik. Technik, 1903, p. 1116.

<sup>3</sup> Marchand: Der Prozess der Wundheilung, mit Einfluss der Transplantation, Stuttgart, 1910.

<sup>4</sup> Joannovics: Cent. f. all. Path. u. path. Anat., 1909, vol. xx, p. 1011.

<sup>5</sup> Marschalko: Arch. f. Dermat. u. Syph., 1895, vol. xxx, p. 214.

<sup>6</sup> Gurd, E. B.: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, p. 169.

<sup>7</sup> Schridde: Münch. med. Woch., 1908, No. 20.

<sup>8</sup> Gurd, F. B.: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, p. 171.

<sup>9</sup> Miller, J. W.: Virchow's Archiv, 1910, vol. 199, p. 482.



FIG. 10.—TYPICAL OPITZ-GEGBHARD GLANDS, SHOWING FERN-LIKE INGROWTHS OF PROLIFERATING EPITHELIUM. Note that the general character of this gland is similar to that of the premenstrual stage, only in this case the changes are more advanced (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909).

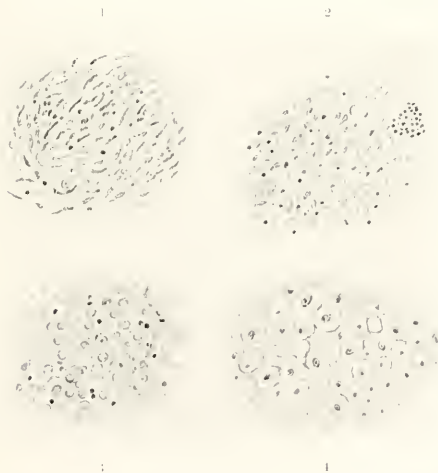


FIG. 11.—STROMA CELLS.

1, Stroma cells in postmenstrual stage. 2, Stroma cells during interval, showing collection of small round-cells. 3, Stroma cells during late premenstrual stage. 4, Decidua cells (C. C. Norris and F. E. Keene, Surg., Gyn., and Obst., January, 1909).



plasma cell. Miller does not believe that Russel's bodies result from hyaline degeneration, and warns against confounding them with vacuolated degeneration of the plasma cell nucleus, or with colloid produced by epithelium.

Gonorrheal endometritis cannot positively be distinguished either macroscopically or microscopically from many other forms of infection of this locality, except by the demonstration of the specific micro-organism in the tissue or exudate. This is usually easy in acute cases, but often difficult after they have become chronic. During the acute stage the endometrium is thickened, reddened, edematous, and hyperemic, and is bathed in a moderately thin, purulent discharge. Areas of subepithelial ecchymosis are often observed, and it frequently happens that the entire mucosa is not equally involved. The surface often presents a granular appearance. During the chronic stage the mucosa may present an appearance differing but little from that of the normal endometrium. It is, however, usually more or less thickened, although atrophic changes sometimes follow subsidence of an acute process. Occasionally the surface presents an irregular, polypoid contour, and granular-like areas may be observed.

*Histology.*—In studying the endometrium the changes incident to the normal menstrual cycle must always be borne in mind, for although the normal changes may be modified as a result of inflammation, they should by no means be overlooked. Data giving the date of the last menstrual period, the regularity and frequency of the periods should be supplied to the pathologist. In gonorrheal endometritis the most marked changes are usually found in the superficial portions of the endometrium.

Acute endometritis is characterized by swelling, edema, and hyperemia of the mucosa. The surface may present areas of granulation, whereas in other parts the surface epithelium may be proliferated and more or less atypical in size, shape, and staining properties. The glands may show varying changes; in some cases they are normal, whereas in others they are enlarged or may be cystic. In some instances, as a result of inflammatory exudates in the stroma, the glands may appear to be contracted. The glandular epithelium is rarely proliferated or desquamated, but usually shows evidences of a well-marked inflammatory reaction. The stroma is infiltrated with serum and polymorphonuclear leukocytes, and often contains free blood. The stroma cells are edematous, and may stain irregularly or imperfectly. The blood-vessels are congested. Generally the myometrium, for a greater or less depth immediately underlying the mucosa, is infiltrated with acute inflammatory products. The areas of infiltration

are often observed surrounding a blood- or a lymph-vessel, and following the course of the latter through the myometrium for some distance.

**Chronic Endometritis.**—During the chronic stage the most marked pathology is usually found in the superficial portion of the endometrium. The surface epithelium is flattened, and in some areas may be desquamated, whereas in others proliferation and even metaplasia to cells resembling squamous epithelium may be present. Runge<sup>1</sup> has called attention to the fact that in some cases of endometritis the ciliated borders of the surface-cells appear to be more robust and resistant than in the normal endometrium, and may be recognized in alcoholic preparations. Hurdon<sup>2</sup> has suggested that these metaplastic changes are possibly analogous to leukokeratosis of the vulvar mucosa. The glands are often enlarged in their deeper portions, and in some instances, due to occlusion or constriction near the surface, may be cystic. Owing to the presence of inflammatory exudates in the stroma, the glands may be somewhat irregularly arranged, some being close together, whereas others are widely separated. The glandular epithelium presents changes similar to those found in the surface-cells, but these are, as a rule, less pronounced. The gland lumina may be empty or may contain serum, leukocytes, blood, or epithelial debris. Adler and Hitschmann<sup>3</sup> assert that in the normal endometrium mucus is not present in the corporeal endometrium during the post-menstrual or interval periods; when the endometrium is the seat of an infection, mucus is not infrequently observed in the glands, and may be present at any time, although it is more frequently observed during the pre-menstrual and early menstrual periods. In chronic endometritis the stroma is more or less densely infiltrated with inflammatory products, and with proper fixing and staining conditions, plasma cells can usually be demonstrated. The blood-vessels, which normally consist only of endothelial tubes, are often found to possess well-developed muscular walls, and may be increased in number. The underlying uterine muscle is usually more or less involved in the inflammatory process.

**Metritis.**—In gonorrheal infections of the uterus the inflammation may be limited to the mucosa or may involve the underlying myometrium. In severe cases the uterine parenchyma, especially the inner layer, is always invaded. In the acute stage the uterus is enlarged, softened, and boggy. The normal shape is usually quite well preserved, although a tendency toward broadening of the organ is gen-

<sup>1</sup> Winter, G., and Runge: Text-book of Gynecological Pathology, edited by J. G. Clark, Philadelphia and London.

<sup>2</sup> Hurdon, E., Kelly, H. A., and Noble, C. P.: Gynecology and Abdominal Surgery, Philadelphia and London, 1907, vol. i, p. 115.

<sup>3</sup> Adler and Hitschmann: Monats. f. Geb. u. Gyn., vol. xxvii, No. 1.



FIG. 12.—HYPERTROPHY OF THE CERVIX, CHRONIC ENDOMETRITIS, CHRONIC METRITIS, AND BILATERAL ADNEXITIS.

The uterus is enlarged, this being especially noticeable in its lateral diameters. The uterine walls are thickened, and the musculature appears somewhat coarser than normal. Here and there, projecting from the cut surface of the musculature, prominent blood-vessels are observed. The endometrial cavity is normal in shape, and the mucosa is but little thickened. The arbor vitæ of the cervical canal are unusually prominent, and in the fresh specimen were considerably reddened. The tubes have been converted into small pyosalpinges. The ovaries are enlarged and contain retention cysts. On microscopic examination they were found to present a well-marked peripheral inflammation and some thickening of the capsule.





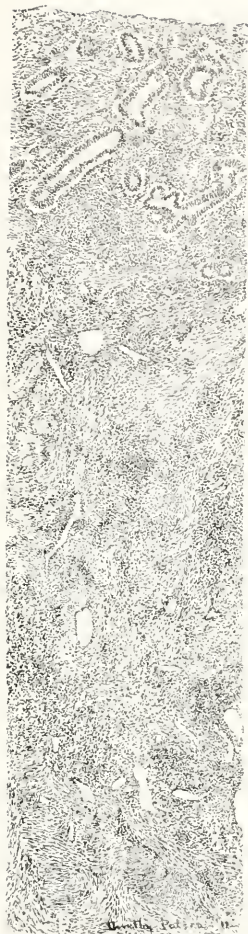


FIG. 13.—ENDOMETRITIS AND METRITIS.

The endometrium is about normal in thickness. The surface epithelium is much flattened. The glands are normal in number and of the interval type. The glandular epithelium also shows degenerative changes, but these are less marked than on the surface. The stroma is infiltrated with inflammatory products, chiefly plasma cells. The underlying musculature also takes part in the inflammatory reaction. This is most marked in the zone immediately underlying the endometrium, and in many areas appears to follow the course of the blood-vessels or lymphatics. Hysterectomy was performed about ten days after a menstrual period had occurred ( $\times 40$ ).



erally seen. In the chronic stage the softening is less marked, but there is nearly always some enlargement, especially in the transverse diameters. Pronounced cases of gonorrheal metritis are usually associated with adnexitis and its accompanying evidences of pelvic peritonitis.

#### GONORRHEA OF THE FALLOPIAN TUBES

The gonorrheal inflammation extends from the endometrium to the Fallopian tube by direct continuity along the mucosa. At first only the mucosa of the tube is involved, but as the disease progresses the muscularis and even the serosa are affected, and various lesions, such as salpingitis, pyosalpinx, hydrosalpinx, tubo-ovarian abscess, or tubo-ovarian cysts, may be produced. With these are associated the usual lesions of pelvic peritonitis. At times a suppurative lesion will be present in one adnexa, whereas the other may be the seat of a hydrosalpinx or a perisalpingitis, or the tube and ovary may be normal; in still other cases bilateral pathology may be present. No rule can be laid down in this respect, except that the more frequent, prolonged, and severe the attacks of pelvic peritonitis have been, the more extensive are the lesions likely to be.

The most frequent pathologic condition produced by a gonorrheal infection of the tube is a pyosalpinx. Among 1070 inflammatory lesions of the tubes seen in the Laboratory of Gynecologic Pathology at the University of Pennsylvania, none of which was associated with neoplasms, there were 425 pus-tubes, 151 cases of salpingitis, 253 hydrosalpinges, 184 cases of perisalpingitis, 38 tubo-ovarian abscesses, and 19 tubo-ovarian cysts.

Gonorrheal lesions of the Fallopian tubes possess certain characteristics that, while not sufficient absolutely to prove the etiology of the infection, are pronounced enough in the great majority of cases to enable the skilled pathologist to be moderately certain of the type of infection present. The fact, as before mentioned, that the gonococcus invades the tubes by means of continuity of the surface mucosa from the uterus, produces certain macroscopic or microscopic pictures that are more or less characteristic. Pyogenic microorganisms, such as the streptococcus and the staphylococcus, reach the tubes by way of either the blood- or the lymph-vessels of the broad ligament, the mucosa not being primarily invaded. In these infectious ovarian abscesses and cellulitis are, therefore, common, while, from the very nature of the gonococcal invasion, these structures are less frequently involved, and such lesions are generally, if not always, secondary to salpingitis. Tuberculosis, which constitutes from 8 to 10 per cent. of all inflamma-

tory tubal lesions, is not infrequently secondary to tuberculosis in other parts of the body, and even when primary, usually produces a characteristic pathology. Small miliary tubercles scattered over the surface of the tube and a tendency toward imperfect closure of the abdominal ostium or the visibility of fimbriae after closure of the outer end of the tube and cheesy contents are almost positive proof of the nature of the infection. The frequency with which the abdominal ostium is not completely closed in tuberculous cases is most striking, and may, in fact, be said to be almost characteristic of this variety of infection. Even when apparently closed, the appearance of fimbriae on the distal end of the tube is most suggestive, and is an important diagnostic aid even before the removal of these organs. An absolute diagnosis of tuberculosis can almost invariably be made with the aid of the microscope. Tubal infections secondary to peritonitis, appendicitis, or general peritoneal conditions affect primarily the outer coats of the tube, and, as a result, the mucosa is often found to be comparatively free from inflammation.

Some authors (Pellagatti, Posner, and Joseph<sup>1</sup>) consider the presence of eosinophiles important in the diagnosis of gonorrhea, especially if they also appear early in the urethral discharge. Taylor,<sup>2</sup> by his own work and by that of others, has shown that these cells are of little value in the determination of the type of the infection. Von Rosthorn,<sup>3</sup> Arthmann,<sup>4</sup> and Wertheim<sup>5</sup> declare that it is impossible to differentiate gonococcal from other acute tubal infections. Zweifel<sup>6</sup> writes that in gonorrheal infection the tubal epithelium is devoid of cilia and is sometimes vacuolated, a condition that is rarely present in septic infections. In 1907,<sup>7</sup> and again in 1908, Schridde<sup>8</sup> directed attention to certain histologic peculiarities of the Fallopian tube attacked by the gonococcus. In the year following Amersbach<sup>9</sup> published a paper from Aschoff's laboratory in which he stated that when the plica of the tube showed swelling and a profuse infiltration with plasma cells, lymphocytes, and lymphoblasts; when the cellular infiltration of the muscularis was composed chiefly of small round-cells, and when not only lymphoid, but plasma cells and lymphoblasts were present in the purulent con-

<sup>1</sup> Pellagatti, Posner, and Joseph: Quoted by Gurd: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, p. 171.

<sup>2</sup> Taylor: Jour. Amer. Med. Assoc., 1907, vol. xlix, p. 1830.

<sup>3</sup> Von Rosthorn: Arch. f. Gyn., 1890, vol. xxxvii, p. 337.

<sup>4</sup> Arthmann: Virchow's Archiv, 1887, vol. cviii, p. 165.

<sup>5</sup> Wertheim: Arch. f. Gyn., 1892, vol. xlii, p. 1.

<sup>6</sup> Zweifel: Arch. f. Gyn., 1891, vol. xxxix, p. 353.

<sup>7</sup> Schridde: Folia Haematologica, 1907, vol. iv, p. 605.

<sup>8</sup> Schridde: Deutsch. med. Woch., 1908, vol. xxviii, p. 1251.

<sup>9</sup> Amersbach: Ziegler's Beiträge f. all. Path., 1909, vol. xlv, p. 341.



FIG. 14.—UTERUS AND ADNEXA FROM A CASE OF PELVIC INFLAMMATORY DISEASE (actual size).

The uterus is normal in size. Its anterior surface presents a few adhesions. The tubes have become converted into pyosalpinges, and are densely adherent to the underlying ovaries. The left adnexa are adherent to the posterior and superior aspects of the uterus, and merge with the tube and ovary of the right side, forming an inflammatory mass, the individual constituents of which were indistinguishable before operation. For six weeks prior to operation this case received palliative treatment. When first observed, the adnexal lesions were at least twice their present proportions.



FIG. 15.—UTERUS AND APPENDAGES FROM A CASE OF ADVANCED PELVIC INFLAMMATORY DISEASE, WITH BILATERAL TUBO-OVARIAN ABSCESSES.

The uterus is normal in shape and slightly enlarged. Its peritoneal surface is covered with adhesions, which are especially numerous on the posterior aspect. The tubes are thickened and infiltrated. In the outer portion they widen out rapidly, and the distal end is buried in the underlying ovarian mass. On section, the walls of the tube are found to be thickened, friable, and edematous. The lumen is lined by a pyogenic membrane, and contains greenish-yellow pus. The ovaries are enlarged, covered with dense adhesions, and here and there contain small retention cysts. The central portion of each ovary is occupied by an abscess cavity which constitutes about one-half or three-fourths of the bulk of the organ. The lumen of the tube opens into the ovarian abscess at a point corresponding to the outer pole of the latter. The tubo-ovarian opening is about 1 cm. in diameter. The adnexa are similar in general characteristics.

tents of the tube, the diagnosis of gonorrhea could be made with a reasonable degree of certainty. These conclusions were based upon a study of 75 cases, 34 of which he considered to be of gonorrheal origin. In only 7 cases were gonococci actually identified. Miller,<sup>1</sup> on the other hand, considers that the plasma cell is by no means characteristic of gonorrhea. Gurd,<sup>2</sup> in an excellent paper on this subject, states that although it is impossible to speak definitely of a distinctive histologic picture of gonorrheal salpingitis, the great preponderance of plasma cells over other inflammatory cells, as well as the localization of the lesion chiefly in the mucosa and submucosa, is very suggestive of the gonorrheal origin of the infection. Gurd's results are drawn from a carefully studied series of 20 cases, in 6 of which the gonococcus was isolated in culture, and although in 5 additional cases the gonococcus was not isolated, this organism was probably the original exciting factor.

Heymann<sup>3</sup> has investigated 50 cases of pyosalpinx from Veit's clinic, with a view to determining whether, in the absence of bacteriologic proof, the histologic appearance can be regarded as a sure indication, and finds that, while on the whole his conclusions coincide with those of Schridde, he does not regard the numerous plasma cells as in themselves diagnostic, but considers that when these elements are numerous, arranged in groups in the muscularis, mucosa, and in the pus in the lumen; when lymphocytes are numerous, and when leukocytes are few or entirely absent, and when there is a broadening out of the plica and an agglutination of their tips, gonorrhea is almost certainly the exciting cause. Krönig,<sup>4</sup> from whose clinic Schridde obtained his material, and Aschoff<sup>5</sup> support Schridde's views, whereas Menge,<sup>6</sup> Walthard,<sup>7</sup> and Miller<sup>8</sup> believe that the histologic picture just described is not peculiar to gonorrhea, but may be produced by any chronic inflammation; they call attention to the fact that plasma cells are by no means confined to the genital tract, and are often observed in other areas from which gonorrhea can be positively excluded.

**Salpingitis.**—During the acute stage the tubes become elongated and swollen. As a general rule, the normal shape of the tube is more or less preserved, although the organ is often kinked and bent upon itself. The surface is congested and vascular, and adhesions which are readily broken up are nearly always present. These adhesions are

<sup>1</sup> Miller, J. W.: Arch. f. Gyn., 1909, vol. lxxxviii, p. 217; also Monats. f. Geb. u. Gyn., August, 1912, p. 211.

<sup>2</sup> Gurd, F. B.: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, pp. 151-184

<sup>3</sup> Heymann: Zeit. f. Geb. u. Gyn., 1912, vol. lxx, No. 3.

<sup>4</sup> Krönig: Monats. f. Geb. u. Gyn., August, 1912.

<sup>6</sup> Menge: *Ibid.*

<sup>7</sup> Walthard: *Ibid.*

<sup>5</sup> Aschoff: *Ibid.*

<sup>8</sup> Miller: *Ibid.*



usually more numerous on the distal part of the tube, since this portion is nearer the abdominal ostium, through which infectious material is often being extruded, and also because in the proximal portion of the tube the walls are thicker and the lumen smaller, containing less mucosa to be attacked. On section, the walls of the tube are found to be soft, congested, and edematous. In the lumen the picture varies according to the portion of the tube examined. The mucous folds are reddened, swollen, and bathed in a purulent or seropurulent exudate. If the disease tends to become chronic, without closure of the external abdominal ostium, the adhesions on the surface become more dense and less vascular. The tube is often bent upon itself, especially in the outer half. In some cases the tubes are but little enlarged, but more often the contrary is the case. At this stage the walls are moderately firm, due to the increase in fibrous connective tissue.

*Histology.*—During the acute period the greatest inflammatory reaction is noted in the mucosa, and in the earliest stage it is entirely confined to this layer of the tube—an endosalpingitis. During the chronic stage there is always more or less involvement of the muscularis. The various coats of the tube are infiltrated with acute or chronic inflammatory products, varying with the stage of the disease. The surface epithelium presents evidences of inflammation, but is rarely desquamated or proliferated. With proper staining, large numbers of plasma cells, together with a varying number of Russel's bodies, can be detected. The inflammatory products tend to extend through the muscularis along the lymph- and blood-vessels, and groups of small round-cells or polymorphonuclear leukocytes, according to the stage of the infection, are seen. In cases of salpingitis the lumen is seldom markedly dilated, and in sections prepared in the ordinary manner it rarely contains much pus. In rare instances a specimen will be seen in which the distal portion of the tube will be comparatively normal, or may be the seat of a moderate degree of inflammation, and in the intramural portion a well-defined, more or less localized abscess is present. These abscesses are usually not large, and generally drain directly into the uterine cavity. The etiology of this condition cannot be determined positively, but in the three cases seen by the writer the suppuration appeared in a tube the seat of an old salpingitis, and hence the suggestion is offered, and indeed it was practically proved in one specimen, that during a previous attack of salpingitis the tube lumen was occluded at about the inner end of the isthmus, and that a reinfection, perhaps with more virulent microorganisms, occurred from the uterus, which, owing to obliteration of the lumen at this point, resulted in the formation of an abscess localized to the cornua of the uterus. Although



FIG. 16. ACUTE GONORRHEAL SALPINGITIS.

This specimen was removed during the early stage of the disease. The tube is somewhat uniformly enlarged, much bent upon itself, and presents numerous adhesions. The abdominal ostium is patulous. The fimbriae are greatly swollen and everted. On milking the tube, pus could be expressed through both ends.

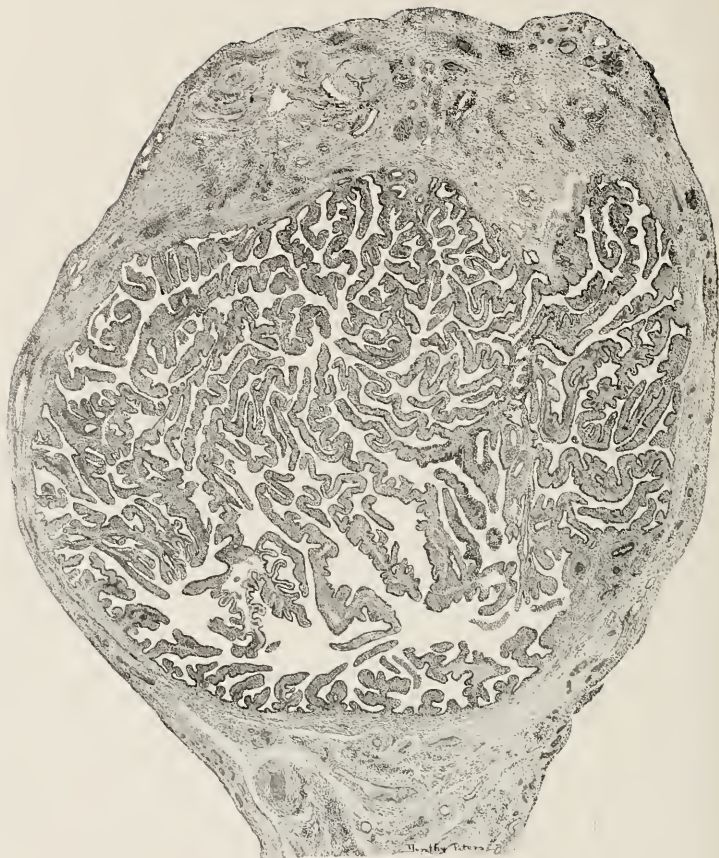


FIG. 17.—GONORRHEAL SALPINGITIS.

The section has been taken through the ampulla of the tube. The muscularis is thin, and contains numerous areas of inflammatory infiltration. The mucous folds are gracile, and their epithelium is somewhat flattened and degenerated. But few pseudo-glands are present. On macroscopic examination a little pus could be seen in the tube. The abdominal ostium was open, although somewhat contracted ( $\times 16$ ).

occurring chiefly within the uterine musculature, these abscesses should by no means be classed as intramural uterine abscesses. They are strictly tubal in origin.

**Pyosalpinx.**—This is the usual termination of a salpingitis, but may occasionally result from a secondary infection of a hydrosalpinx. The actual method of closure of the external abdominal ostium is still somewhat in doubt. Doran,<sup>1</sup> Kleinhaus,<sup>2</sup> Opitz,<sup>3</sup> Ries,<sup>4</sup> and Young<sup>5</sup> have devoted papers to a description of the manner of closure of these tubes. The last-named observer summarizes the various theories as follows, dividing them into two classes: Class 1 includes those theories that explain the process as being due to an increase in the total length of the tube-wall, which, by expanding in an outward direction, becomes projected beyond the tubal fimbriæ. According to the theory of Doran,<sup>6</sup> and Kleinhaus,<sup>7</sup> the increase in length is dependent on swelling and increase in the substance of the tube-wall, associated with salpingitis, etc. According to Ries,<sup>8</sup> the gliding outward of the "peritoneal ring" over the fimbriæ is rendered possible by the fact that the walls become loose and redundant subsequent to the collapse of a distended tube. In Class 2 are included the theories of Opitz<sup>9</sup> and Young; the first explains the process as due to a retraction of the muscularis and mucosa of the tube within the serous coat, and the latter<sup>10</sup> claims that the gliding process involves only the mucosa and inner coat of the muscularis. The so-called perimetritic closure of Doran<sup>11</sup> is explained by the matting together of the fimbriæ by inflammatory adhesions without preliminary recession. The latter obviously rarely occurs in gonorrhea. In many instances the intramural portion of the tube probably becomes occluded somewhat earlier than does the external abdominal ostium. This occlusion is the result of agglutination of the mucosa. In some cases this becomes permanent, whereas in others leakage occurs at irregular intervals. In some specimens the occlusion is largely induced mechanically, as the result of a kink or bend.

Pyosalpinges vary markedly in size. Enormous tubal abscesses

<sup>1</sup> Doran, A.: Trans. London Obst. Soc., December 4, 1889.

<sup>2</sup> Kleinhaus: Veit's Handbuch, first edition, vol. iii, No. 22, p. 690.

<sup>3</sup> Opitz: Zeit. f. Geb. u. Gyn., 1904, vol. lii, p. 485.

<sup>4</sup> Ries, E.: Amer. Jour. Obst., August, 1909.

<sup>5</sup> Young, J.: Jour. Obst. and Gyn., British Empire, 1910, vol. xvi, p. 307.

<sup>6</sup> Doran, A.: Trans. London Obst. Soc., December 4, 1889.

<sup>7</sup> Kleinhaus: Veit's Handbuch, first edition, vol. iii, No. 22, p. 690.

<sup>8</sup> Ries, E.: Amer. Jour. Obst., August, 1909.

<sup>9</sup> Opitz: Zeit. f. Geb. u. Gyn., 1904, vol. lii, p. 485.

<sup>10</sup> Young, J.: Jour. Obst. and Gyn., British Empire, 1910, vol. xvi, p. 307.

<sup>11</sup> Doran, A.: Trans. London Obst. Soc., December 4, 1889.

have been described by Richardson,<sup>1</sup> Genter,<sup>2</sup> and others. In Richardson's case the pyosalpinx was at first mistaken for a large myoma of the uterus. The distended tube extended upward to the umbilicus. The author has operated in the Philadelphia Hospital upon a case of pelvic inflammatory disease in which one pyosalpinx measured 14.75 cm. in length and had a diameter of 5.5 cm., while the tubal abscess on the opposite side measured 13 cm. by 7.5 cm. in diameter. Such huge dimensions, however, are extremely unusual. The surface of the tube is covered with dense adhesions, and is sometimes greatly congested, producing a dark-red color, while in other specimens the tube has a yellowish tint. A pyosalpinx is usually of a sausage shape, the enlargement being confined chiefly to the distal two-thirds of the tube. The tubes may, however, be cylindric or even pear shaped. The uterine extremity of the tube may be but little enlarged. Only rarely are fimbriae visible. The tubes are frequently bent upon themselves, and more or less thickening and induration are always present in the mesosalpinx. The walls of the tube vary widely in different cases, the thickness bearing no relation to the diameter of the tube or of the lumen. In some small pyosalpinges the walls are thick, whereas in those of large size they may be thin, or the reverse may be observed. As a rule, the walls are moderately thick—much thicker than when the contents are serous. The walls are often friable and edematous. The lumina vary in size, the greatest amount of dilatation nearly always being found in the ampulla. In recent cases the mucosa is intact, but in old chronic specimens it may be entirely disintegrated and replaced by a pyogenic membrane or by granulation tissue. The contents of the lumen are, as a rule, moderately thick, and consist of yellowish, greenish, or brownish pus. In acute cases gonococci can almost invariably be recovered from the pus, either by culture or smear. Gurd<sup>3</sup> believes that the reason cultures frequently prove negative is that the material is generally taken from the free pus, in which locality the organisms are often dead, disintegrated, or at least attenuated. If the cultures are made from portions of curetings scraped from the tubal mucosa and underlying tissue, gonococci can more often be demonstrated. As has been stated by Wolff,<sup>4</sup> the cytologic examination of the tubal contents is at best unreliable for the diagnosis of gonorrhea.

*Histology.*—The microscopic picture varies widely in different

<sup>1</sup> Richardson: Johns Hopkins Hosp. Bull., January, 1909, p. 21.

<sup>2</sup> Genter, G.: Vrach. Gaz., St. Petersburg, 1911, vol. xviii, p. 829.

<sup>3</sup> Gurd, F. B.: Jour. Med. Research, 1910, vol. xxiii; new series, vol. xviii, pp. 151-184.

<sup>4</sup> Wolff, A.: Zent. f. Gyn., Leipzig, 1912, vol. xxxvi, No. 49.



FIG. 18.—UNUSUALLY LARGE PYOSALPINX.

This specimen has shrunk to two-thirds its original size. Practically the entire tube has been converted into an abscess cavity. The surface presents a number of dense, fan-like adhesions. The tube is sharply kinked upon itself. On section, the walls are found to be thickened and edematous, and the mucosa is largely replaced by a pyogenic membrane. The lumen contains thick, greenish-yellow pus. The opposite tube was the seat of a similar lesion.





FIG. 19.—SECTION THROUGH AN ADVANCED CHRONIC PYOSALPINX.

The peritoneal coat shows a few adhesions. The muscularis is thickened, infiltrated with inflammatory products, and contains an excess of fibrous tissue. The blood-vessels are engorged, the mucosa is thickened, and the surface epithelium is either desquamated or greatly degenerated. In many cases the swollen mucous folds have become agglutinated, and the development of small pseudo-glands has resulted. The stroma of the mucosa is infiltrated. The most marked pathologic changes are observed near the surface ( $\times 12$ ).



specimens. All the coats of the tube are, however, more or less infiltrated with inflammatory products. The mucosa is, as a rule, most severely involved. The infiltration is especially profuse about the blood- or lymph-vessels. This is particularly noticeable in the muscularis. As has been stated, the mucosa may be entirely absent; more often, however, the plicae are swollen, and the investing epithelium is more or less degenerated, and frequently irregular in size, shape, and staining properties. In some specimens the epithelium is intact, whereas in others extensive areas of desquamation can be observed. It is probable that, under favorable circumstances, areas of desquamated epithelium are sometimes replaced by new cylindric cells—the so-called plastic epithelium of Menge.<sup>1</sup> In many instances, as a result of gonorrhea, the tubal epithelium loses its cilia. This is said by many authors to be one of the etiologic factors in the production of extra-uterine pregnancy. Occasionally metaplasia of the tubal epithelium to cells resembling the squamous type is observed.

Pseudo-glands, formed by the agglutination of the tips of the mucous folds, are frequently present. These vary much in size and in different specimens. In chronic cases the muscularis contains an excess of fibrous tissue and is more or less densely infiltrated with inflammatory products. Large numbers of plasma cells are usually observed. These are found not only in the muscularis, but also in the mucosa and in the lumen. They are usually arranged in clusters. Leukocytes, except in acute cases, are seldom present. Lymphocytes, the lymphoblasts of Schridde,<sup>2</sup> or large lymphocytes, and also Krompecher's<sup>3</sup> mast cells, are often seen. The last-named are moderately large cells, which contain coarse, deeply staining basophilic granules, and possess a nucleus similar in shape and staining properties to that of the plasma cell. Occasionally a few hyaline-like, homogeneous, pink-staining bodies, six or seven times the size of a plasma cell, may be observed. These are known as Russel's bodies. Mitosis is frequent. The serosa is thickened, and a well-developed inflammatory membrane of exudate, consisting of a fine fibrous meshwork, in which numerous small round-cells, polymorphonuclear leukocytes, or free blood may be present, according to the stage of the disease.

**Hydrosalpinx.**—This condition, as its name indicates, is a distention of the tube with serous or watery fluid. These tubal enlargements may be produced in three ways: (1) By an inflammation from

<sup>1</sup> Menge, K.: *Hand. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>2</sup> Schridde: *Münch. med. Woch.*, 1908, No. 20; also *Deutsch. med. Woch.*, 1908, vol. xxviii, p. 1251.

<sup>3</sup> Krompecher: *Ziegler's Beiträge f. all. Path.*, 1898, vol. xxiv, p. 163.

within which seals both ends of the tube and allows fluid to accumulate within the lumen. The mechanism under these circumstances is very similar to that which produces a pyosalpinx, differing only in the fact that the inflammation does not progress to the stage of pus-formation. These specimens are known as pseudofollicular hydrosalpinges and are the most frequent variety of a gonorrheal hydrosalpinx. As in the production of a pyosalpinx, the closure may be largely the result of inflammatory stimuli from without the tube—the perimetritic closure of Doran.<sup>1</sup> In this type the chief inflammatory changes are found in the outer layers of the tube, and, as a result, the plica are not extensively involved, except by the changes resulting from intratubal pressure. These are the specimens which are described in the literature as sactosalpinges simplex, and are rarely of gonorrheal origin. They often assume a large size. They are generally of puerperal origin, and may be due to an infection occurring through the lymph-channels in the broad ligament. Kleinhaus,<sup>2</sup> in a series of 15 such tubal lesions, found that 11 were of puerperal origin. The third method of production of a hydrosalpinx is by the conversion of the pus in a pyosalpinx into serous fluid. The transformation of a pyosalpinx into a hydrosalpinx is probably of rare occurrence. Menge,<sup>3</sup> basing his opinion on histologic grounds, questions if it ever occurs. Bland-Sutton<sup>4</sup> is of the opinion that it occasionally happens.

A hydrosalpinx may be viewed as a form of tubal retention cyst. The affected tubes vary markedly in size, but as a rule they are considerably larger than are purulent collections. The author saw an unusual case in which two tumors, each the size of a fetal head, were present. On examination, one of these proved to be an enormous hydrosalpinx and the other a tubo-ovarian cyst. Godart<sup>5</sup> has recently reported an enormous hydrosalpinx which, at first sight, might easily have been mistaken for an ovarian cyst. The tumors are generally retort-shaped, the swelling starting at the inner portion of the isthmus, and rapidly widening out until the outer portion of the ampulla is reached. Occasionally the enlargement is spheric. In some instances the enlargement occupies the entire extramural portion of the tube, whereas in others only the ampulla is increased in diameter. The external abdominal ostium may be totally obliterated, or a dimple may exist at the site of the tubal closure. The mesosalpinx does not

<sup>1</sup> Doran, A.: *Trans. London Obst. Soc.*, December 4, 1889.

<sup>2</sup> Kleinhaus: *Veit's Handbuch*, vol. iii.

<sup>3</sup> Menge: *Cent. f. Gyn.*, 1895, vol. xix, p. 799.

<sup>4</sup> Bland-Sutton: *Diseases of the Ovaries and Fallopian Tubes*, second edition, 1896, pp. 216-220.

<sup>5</sup> Godart, J.: *Poliecin. Brux.*, 1912, vol. xxi, p. 88.

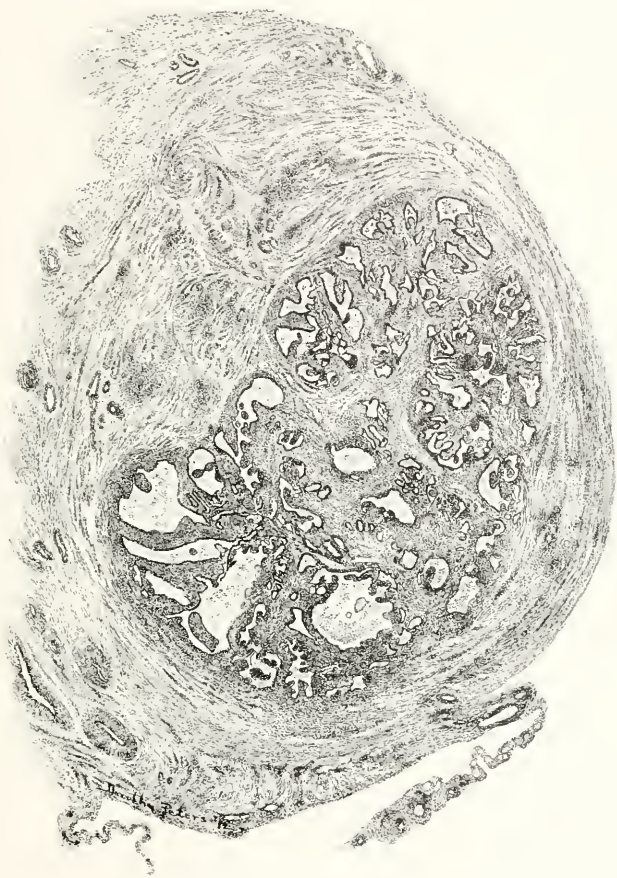


FIG. 20.—SECTION THROUGH A PROSALPINX.

The surface presents a few adhesions. The muscularis is thickened, fibrous, and infiltrated with inflammatory products. The mucosa is much thickened. Large numbers of pseudo-abscesses which vary considerably in size are seen. The epithelium is generally present, but is markedly flattened and degenerated. The stroma is densely infiltrated with inflammatory products. Considerable pus is present in the lumen ( $\times 15$ ).

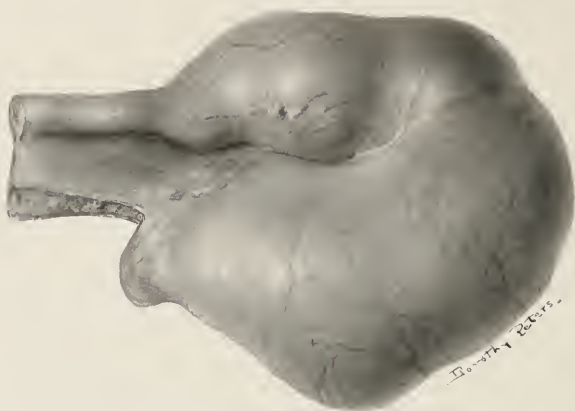


FIG. 21.—HYDROSALPINX.

The tube has been converted into a retort-shaped, thin-walled cystic tumor. The inner third of the tube is about normal in diameter. From this point it rapidly widens out and the walls become thin. The abdominal ostium is completely closed, and its original location is marked by a small dimple. On section, the walls are found to be thin, the mucosa is smooth, and the lumen contains clear, straw-colored fluid.

lengthen out proportionately to the increasing size of the tube, and, as a consequence, the hydrosalpinx is generally considerably bent or even kinked upon itself. The ovary often lies in the concavity of the tube. Adhesions are, as a rule, less dense and numerous than when the tube contains pus. Sometimes the inner half of the tube is but little enlarged, and forms a pedicle for the retention cyst, which may be comparatively free from adhesions. These are the types of specimens in which torsion is likely to occur. The walls of a hydrosalpinx are usually thin, and the lumen is correspondingly dilated. In some specimens, when the lumen is incised, the remains of the plicæ can be distinguished macroscopically, whereas in others the lining of the tube appears to be smooth. In some instances, owing to the formation of pseudo-glands, practically the entire lumen is occupied by what appears to be serous cysts, which vary widely in size, and are generally more or less concentrically arranged about a minute central cavity—the true lumen. The contents of the lumen are made up of thin, yellowish or colorless fluid, in which gonococci can rarely be demonstrated. Occasionally the fluid is turbid, or may be dark from the admixture of blood. In cases of tubal pregnancy hydrohematosalpinges are frequently present in the opposite side, and under such circumstances are probably often due to the admixture of blood incident to the pregnancy, to a preëxisting hydrosalpinx. Hydrohematosalpinges may also result from tubal neoplasm, such as papilloma or carcinoma.

**Hydrops tubæ profluens**, or intermittent hydrosalpinx, is a condition in which the proximal end of the tube is not permanently occluded, but when the intratubal pressure reaches a certain point, opens out, allowing the tubal contents to escape through the uterus. In these cases the stenosis at the uterine end of the tube may be inflammatory or purely mechanical in nature, resulting from a kink or bend in the tube.

*Histology.*—Microscopic examination can, as a rule, determine the method of formation of the hydrosalpinx. In the case of hydrosalpinx simplex, the plicæ are free, although they are more or less stunted and their epithelium is free from inflammatory change. The chief inflammatory lesion is situated in the external layers of the tube. In a hydrosalpinx that was formerly a pyosalpinx the muscularis contains a well-marked excess of fibrous tissue; it is generally more or less infiltrated with inflammatory products, while the epithelium of the mucosa, and even the stroma, usually presents well-defined evidences of a preëxisting destructive inflammation. In the ordinary follicular hydrosalpinx the inflammatory reaction is confined

chiefly to the mucosa, and numerous pseudo-glands, formed by an agglutination of the tips of the mucous folds, are present. The epithelium is comparatively normal, and does not exhibit the marked inflammatory changes seen in a case of a converted pyosalpinx. The peritoneal surface of a hydrosalpinx usually presents adhesions; the muscularis is thin and stretched, due to the intratubal pressure, and may be more or less infiltrated with small round-cells, plasma cells, lymphocytes, polymorphonuclear leukocytes, and serum. As a rule, comparatively few active inflammatory products are present. This, however, depends largely upon the form of the hydrosalpinx and the stage of the infection.

#### GONORRHEA OF THE OVARIES

**Peri-oöphoritis.**—As a result of gonorrheal tubal lesions, more or less infected material escapes into the pelvis and over the ovaries, which, from their situation, are particularly prone to be thus contaminated. As a result, a peri-oöphoritis develops, and the ovary may become adherent to the tube, the posterior surface of the broad ligament, the omentum, the bowel, chiefly the rectum or sigmoid flexure, or the pelvic peritoneum. The changes taking place on the surface of the ovary and in the pelvic peritoneum seem at first to consist of the formation of a fine plastic membrane from which adhesions subsequently develop. As the result of adhesions and a thickening of the capsule of the ovary, retention cysts, usually follicular in nature, although sometimes of lutein origin, ensue. Not infrequently the ovary is found to be embedded in a mass of adhesions, but is not otherwise involved. The method of ovarian infection and its character in cases of gonorrhea are of the utmost importance, because of their bearing on conservation of the ovary when operating upon cases of pelvic inflammatory disease. The recognition of the fact that in the vast majority of cases the infection is due to surface contamination, and is not the result of gonococci within the ovary, is of the utmost importance. The prognosis in cases of conservation would naturally be much less favorable if the latter were the case. In some cases the disease may subside without further involvement. In pelvic inflammatory disease peri-oöphoritis is the most frequent pathologic condition encountered. Among 490 ovaries removed for pelvic inflammatory disease in the Gynecologic Department of the University of Pennsylvania, 266 were the seat of a peri-oöphoritis, 122 of an oöphoritis, in 44 abscesses were present, 17 were cases of tubo-ovarian cysts, and 41 were tubo-ovarian abscesses, showing that peri-oöphoritis is more than twice as frequent as any other inflammatory lesion. In considering the frequency from



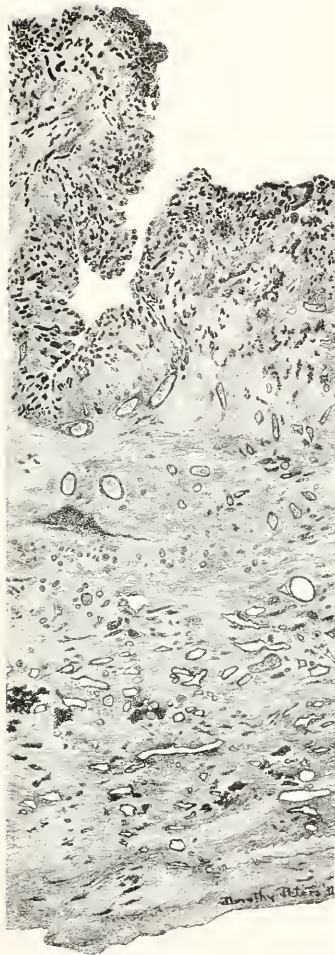


FIG. 22.—CROSS-SECTION THROUGH AN OVARIAN ABSCESS OF LUTEIN ORIGIN

The presence of acute oöphoritis is apparent, and is characterized by infiltration of polymorphonuclear leukocytes, serum, free blood, and a few plasma cells. The lutein lining of the abscess can still be distinguished. It is in the latter location that the inflammatory reaction is most intense ( $\times 15$ ).





FIG. 23.—PYOSALPINX AND OVARIAN ABSCESS.

The tube has been converted into a club-shaped pyosalpinx. On section, the walls were found to be thickened and edematous. The ovary was enlarged, covered with adhesions, and was found to be the seat of an abscess, evidently the result of an infection of a corpus luteum. No communication existed between the abscess cavities of the tube and ovary.

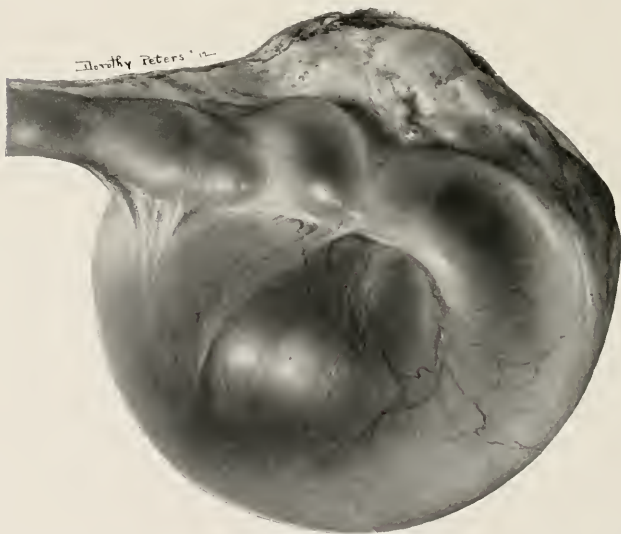


FIG. 24.—TUBO-OVARIAN CYST.

The tube has been converted into a retort-shaped, thin-walled cyst, the lumen of which communicates with a large serous accumulation of the ovary.

a study of the statistics just cited, it should be taken into consideration that this is a conservative clinic, and that many ovaries the seat of a peri-oöphoritis have not been removed, whereas those organs the seat of a more severe lesion, such as advanced oöphoritis or an abscess, have been excised almost routinely.

**Oöphoritis.**—In many instances a peri-oöphoritis may extend to the substance of the ovary. It has been suggested by some authors that in rare cases the gonococcus may reach the ovary by way of the blood- or lymph-channels from either an infected uterus or a diseased tube. Theoretically this is, of course, possible, but its occurrence has, however, never been proved and is open to grave doubt. The author has never seen a case of gonorrheal peri-oöphoritis or oöphoritis without an accompanying endosalpingitis. The most frequent route of infection is through a recently ruptured follicle. As a result of infection the ovary becomes enlarged and edematous, and the tendency for the formation of retention cysts becomes increased. Such ovaries are rarely larger than a hen's egg, and are often but little increased in size. During the chronic stage sclerotic changes are common, and the ovary may even be smaller than normal. As a rule, multiple retention cysts are present. Occasionally one or two of these show a tendency to become pedunculated, or the cysts may be deep in the ovarian stroma. The periphery of the organ is chiefly involved, and presents a more or less well-marked inflammatory reaction of either an acute or a chronic character. Some specimens may show a marked excess of fibrous tissue, whereas in others the tendency toward fibrocytic degeneration may be observed. Very often the number of normally developed follicles is much reduced.

**Abscess of the Ovary.**—This usually results from infection of a follicle or a corpus luteum. The follicle ruptures in an ovary perhaps previously the seat of a peri-oöphoritis, and in this way gonococci gain access to the substance of the organ. As has been previously stated, this may result in a simple oöphoritis or an abscess may occur. Either a Graafian follicle or a corpus luteum may, therefore, become the seat of suppuration. Mixed infections are not infrequent. Jadassohn<sup>1</sup> believes that these lesions are pseudo-abscesses. Sometimes the tissue surrounding a Graafian follicle or a corpus luteum becomes involved, and a true interstitial abscess results. A general oöphoritis accompanies all ovarian abscesses. Interstitial abscesses may, perhaps, occasionally occur independently of the rupture of a follicle. Ovarian abscesses vary from those of microscopic dimensions to those the size of the fetal head or even larger. The ovary can

<sup>1</sup> Jadassohn: Verhandl. des IV. Deutschen Dermat. Kong., Vienna.

accommodate itself more readily to enlargement than can the tube.

**Tubo-ovarian Cyst.**—This is a combination of a hydrosalpinx and a retention cyst of the ovary, the lumen of the one communicating with the cystic cavity of the other. This lesion is produced by the fimbriæ becoming adherent to the surface of the ovary, and the subsequent rupture of a follicle at the point of adhesion. The tube usually resembles an ordinary hydrosalpinx, except that the distal extremity is adherent to or buried in the ovary. The ovarian portion of the cyst is generally about the size of a lemon, but it may be much larger. The cysts occasionally show a tendency to become pedunculated, and are generally moderately thin walled. The inner surface is smooth, and the contents are similar to those of a hydrosalpinx. The communication between the tube and ovary is usually a free one.

**Tubo-ovarian Abscess.**—The etiology of a tubo-ovarian abscess is similar to that of a tubo-ovarian cyst. Less frequently an ovarian abscess may rupture directly into the body of an adherent tube, and in this way a communication between the two be established. Tubo-ovarian abscesses are generally somewhat smaller than tubo-ovarian cysts, and are likely to be more adherent. Occasionally an ovary the seat of a tubo-ovarian abscess may also contain other areas of suppuration, and retention cysts are often present. In shape and appearance the tube resembles an ordinary pyosalpinx. The pus in these specimens is thick, creamy, greenish, yellowish, or blood-streaked, and during the acute stage it contains numerous gonococci. During the chronic stage gonococci are less abundant, and not infrequently they are absent or of attenuated virulence. Cultures or smear preparations should be made from cureted particles of the abscess-wall, rather than from the free pus, as the former locality is more likely to contain active organisms. The mesosalpinx is, as a rule, much thickened.



FIG. 25.—UTERUS AND APPENDAGES FROM A CASE OF ADVANCED PELVIC INFLAMMATORY DISEASE.

The uterus is enlarged, but its general shape has been preserved. The surface is covered with adhesions, and the walls are slightly thickened, especially in their transverse diameters. The mucosa is congested and somewhat hypertrophied. The tubes have been converted into pyosalpinges. They are covered with adhesions, some of which on the left side are omental in origin. They are strongly adherent to the underlying ovaries, which are enlarged, covered with adhesions, and contain numerous retention cysts varying in size from microscopic growths to those 1 to 2 cm. in diameter. Three small peritoneal cysts are also shown on the left adnexa.

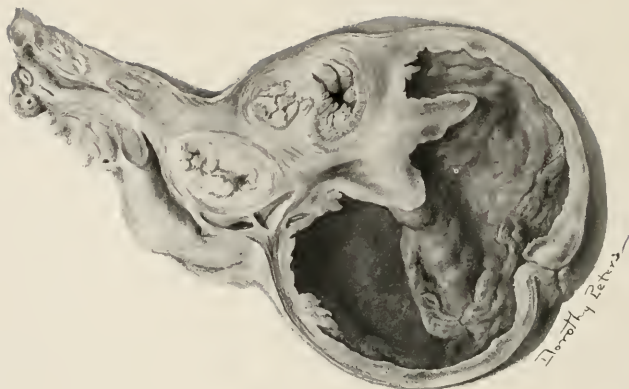


FIG. 26.—TUBO-OVARIAN ABSCESS.

The tube presents the usual appearance of a pyosalpinx, except that the distal extremity is buried in the underlying ovary and the lumen of the tube communicates by a wide opening with an ovarian abscess that constitutes the greater bulk of the latter organ. The contents of the abscess consist of moderately thin, purulent material.

## CHAPTER IV

### PATHOGENESIS

GONORRHEA in the adult is usually contracted through sexual intercourse. Although much has been written of other modes of infection, the fact remains—and but few gynecologists or genito-urinary specialists of wide experience will refute the statement—that of every hundred gonorrheics, ninety-nine contracted their infection through coitus. It must be remembered, however, that gonorrhea may be contracted by other means, and for this reason patients should be given the benefit of the doubt. One reason why gonorrhea is not often contracted except through sexual congress is due, as has previously been pointed out, to the fact that if exposed to room temperature or allowed to dry, the gonococcus loses its virulence or perishes in a few hours. Were it not for these characteristics, gonorrhea would be much more prevalent, and epidemics would occur frequently. With few exceptions the gonococcus develops only on columnar epithelium, and, therefore, in order to transmit infection, it is necessary for the secretion containing the gonococci to be introduced upon such soil in a comparatively short time after its discharge from its original host. From this it will be apparent that gonorrhea may, in rare instances, be acquired without sexual intercourse, and authentic cases are on record in which the disease has been transmitted through the medium of infected towels, clothing, surgical dressings, douche-nozles, water-closets, or even the bath-tub or the swimming-pool. Although rare among adults, hand infection has been observed. Men have been infected as the result of using second-hand condoms, which they obtained from their female partners or from the keepers of houses of prostitution, these unfortunates falling victims to the very prophylaxis they were attempting to carry out. Instances are not lacking to show that patients have at times been contaminated through dirty instrumentation, or as a result of improper aseptic technic during pelvic examinations, local treatment, or minor surgical operations. Among children, and in organs other than the genitalia, gonorrheal infection usually takes place by different means than those mentioned. These modes of infection will be dealt with under their respective headings.

When infection takes place, the number of gonococci that obtain access to the urethra or other portions of the genital tract is extremely

small. Wertheim's<sup>1</sup> experiments tend to show that the actual number of gonococci introduced upon the mucous membrane is of comparative unimportance. Abrasion of the surface upon which the organisms are deposited is not necessary for infection. The period during which the organisms are multiplying, and before subjective symptoms result, is known as the stage of incubation. Accurate statistics relative to the period required for the incubation of gonorrhea in women are obtained with difficulty, as the initial symptoms of this disease in the female sex are often so slight, and of so insidious or transitory a character, that the actual date of onset is difficult to determine definitely, and, as a further hindrance, the onset is, as a rule, so mild that the physician is rarely consulted until the disease has made considerable progress. In fact, when the infection is confined to areas below the internal os, it is not uncommon for the patients to be in ignorance of the existence of the disease. In the male the condition is different, and it is comparatively easy to obtain accurate data on this point. The following statistics are gathered from the report of 470 cases by Eisenmann, Hacker, and Hoelder:

Period of incubation.....	1 day	in	11 cases
" " ".....	2 days	"	59 "
" " ".....	3 "	"	126 "
" " ".....	4 "	"	62 "
" " ".....	5 "	"	49 "
" " ".....	6 "	"	10 "
" " ".....	7 "	"	63 "
" " ".....	8 "	"	12 "
" " ".....	9 "	"	12 "
" " ".....	10 "	"	23 "
" " ".....	11 "	"	6 "
" " ".....	12 "	"	8 "
" " ".....	13 "	"	6 "
" " ".....	14 "	"	19 "
" " ".....	19 "	"	2 "
" " ".....	20 "	"	1 case
" " ".....	30 "	"	1 "

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470 cases

The statistics by Lanz<sup>2</sup> compiled from 40 carefully selected cases are:

Period of incubation.....	1 day	in	2 cases
" " ".....	3 days	"	15 "
" " ".....	4-7 "	"	17 "
" " ".....	8-14 "	"	3 "
" " ".....	20 days or more	"	3 "

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40 cases

Keyes<sup>3</sup> records that the average incubation in 34 primary attacks of urethritis was six days, and that among patients who had previously

<sup>1</sup> Wertheim: *Wien. klin. Woch.*, 1894, No. 24.

<sup>2</sup> Lanz, A.: *Arch. f. Dermat. u. Syph.*, Vienna and Leipzig, 1893.

<sup>3</sup> Keyes, E. L.: *Diseases of the Genito-urinary Organs*, 1911, p. 159.



had gonorrhea, the average duration among 76 cases was 4.88 days. Of the primary attacks, 20 per cent. appeared prior to the fifth day, and of the secondary attacks, 55 per cent. became manifest in a like period.

From these studies it will be seen that the greatest number of cases develop on the third day, and that more than two-thirds become evident within the first week. An incubation period of more than ten days is extremely rare, and the more carefully these cases are observed, the fewer will be found to exceed this period. Although undoubtedly authentic cases have been reported in which the disease became manifest more than two weeks after infection,—and, indeed, Lanz quotes one case in which the incubation period was seventy days,—such reports should be regarded with suspicion, for even if the patient's veracity is beyond dispute and a previous infection can be excluded, the possibility of accidental inoculation must always be borne in mind. Extremely short periods of incubation, such as twenty-four hours or less, are also open to strong doubt, and are suggestive of a previous infection. In these patients the condition is generally due to the lighting up of an old chronic condition that had previously been overlooked. The period of incubation is of importance, at least theoretically, as it draws a sharp line of distinction between gonorrhea and the traumatic or chemic inflammations, the reactions of which occur within a few hours after the injection of the etiologic factor. Experimental inoculations with pure cultures of gonococci have produced a urethritis in periods varying from twelve to seventy-two hours. These variations in time are due to a number of factors. Indubitably great differences exist in the resistance power of various individuals to infection by the gonococcus. That different strains of gonococci have varying degrees of virulence has also been pointed out by many authorities. Bandler<sup>1</sup> suggests that the microorganisms present in acute gonorrhea produce an acute inflammation, and that the gonococci from a chronic case, when infecting another individual, produce a chronic condition. Döderlein makes a somewhat similar statement. That some gonorrheas are subacute from the onset is true, but ample proof can be adduced that this theory does not hold good in all cases. As has previously been stated, however, the virulence of the gonococcus is somewhat variable. That different degrees of virulence exist among gonococci is indicated by the fact that several individuals contaminated at the same source have all been observed to develop metastatic gonorrhea. Ahmann's<sup>2</sup> experiment is still more suggestive. This investigator

<sup>1</sup> Bandler: *Jour. Amer. Med. Assoc.*, February 1, 1908, p. 339.

<sup>2</sup> Ahmann: *Arch. f. Dermat. u. Syph.*, 1897, vol. xxxix, p. 323.

inoculated the healthy urethra of a man with blood from an individual suffering from a gonorrheal septicemia: not only did a urethritis result, but also a general gonorrheal infection, with localization in the lung and synovial sheaths. Trauma to the urethra is a predisposing factor to gonorrhea. McDonagh<sup>1</sup> states that the shorter the period of incubation, the more acute is the case likely to be. The same authority believes that subsequent attacks are prone to be of longer duration, and of a more chronic character, than are first infections. First attacks are usually more severe and acute, so far as local manifestations are concerned. Subsequent attacks are more prone to be complicated by arthritis, endocarditis, or other local or general evidences of a gonosepticemia. Morton<sup>2</sup> believes that gonorrhea in tuberculous or debilitated patients is prone to be subacute from the onset and to run a protracted course. The part attacked is also a factor to be taken into consideration in studying the duration of the period of incubation, some locations causing symptoms and being more favorable for the development of the gonococcus than others. Bumm rightly lays particular stress upon this point.

The gonococcus is, indeed, a peculiar organism; it is grown only with extreme difficulty on artificial media, perishing rapidly if not frequently transplanted, and under such conditions easily destroyed by extraneous influences, such as heat, cold, or weak antiseptic solutions; on favorable soil, however, like the female genital tract, it produces a disease the chronicity of which is one of its chief characteristics. The dictum of Noeggerath, "Once infected always infected," is borne out in a large proportion of cases, and is true of nearly all female patients that are not subjected to proper treatment. Indeed, the chronicity of the disease has led to the well-known aphorism that "All attacks of gonorrhea are curable except the first." Compared with other pyogenic microorganisms like the streptococcus or the staphylococcus, the gonococcus possesses little or no power of penetration, and although the mucous membranes are not its only habitat, nevertheless it is on these structures that it usually develops.

In the genital tract of both men and women, but more especially in the latter, the gonococcus may lie dormant for indefinite periods. In women the three areas most frequently infected are the urethra, the cervix, and Bartholin's glands. In a given case the part infected depends upon certain conditions. Thus if the introitus is small or the male organ disproportionately large, the urethra is most likely to be contaminated, whereas if the pelvic floor is relaxed and the external

<sup>1</sup> McDonagh, J. E.: *The Practitioner*, 1909, vol. lxxxi, p. 534.

<sup>2</sup> Morton, H. N.: *Genito-urinary Diseases and Syphilis*, Philadelphia, 1912, p. 39.

orifice gaping, the cervix is most frequently infected. In women or young girls infected during an incomplete coitus, or as a result of rape, the urethra and external genitalia are naturally most exposed to contamination. A urethritis may often be warded off by washing out the urethra by urination immediately after an impure coitus, or infective material may be removed from the cervix by a copious antiseptic douche taken immediately after a suspicious intercourse. These factors doubtless play a decided part in the infection of one area and the escape of another. In the urethra, because of the anatomic formation and the short length of the canal, the subjective symptoms are usually mild, consisting of, at most, a slight frequency of and burning on micturition, which rarely last more than a few days. The chief symptom of a cervicitis is an increase, usually not great, of leukorrheal discharge, which usually also changes somewhat in character, whereas a Bartholinitis often results in nothing more than a slight itching or irritation of the vulva. Even with acute infection of all these locations the symptoms are sometimes so transient or of so mild a character that the patients, unless on the lookout for infection, pay no heed to their condition, and when the disease becomes chronic, they are, of course, ignorant of its existence. This is especially likely to be true if the patient is a woman of unclean habits or of sluggish sensibilities. Even when actual symptoms are noticed, a feeling of shame will sometimes prevent the patient from consulting a physician, and as the acute stage disappears quickly, the woman naturally believes that nothing serious has occurred and the entire incident is often forgotten. Menge<sup>1</sup> states that the manner in which the disease is often spread is as follows: A husband infected with a chronic gonorrhea, out of courtesy to his young wife, and because he does not wish to cause her pain, does not rupture the hymen at the first intercourse; hence the infectious semen is deposited at the orifice of the urethra and at the openings of Bartholin's glands. As a result, an acute vestibular gonorrhea, urethritis, and Bartholinitis occur. This condition, of course, causes considerable pain, and intercourse ceases. If the woman is seen in this condition by a competent physician, she can easily be treated and the spread of the disease prevented; but most of these patients, on account of a sense of modesty, do not consult a physician, and attribute these symptoms to defloration. As a rule, they employ douches, and in this way carry the infected material from the outside into the vagina, and thus transfer the disease to the cervix. It does not seem to the author that this mode of infection is a very frequent one. The incubation stage of gonorrhea lasts at least two or three days, and it does not appear likely

<sup>1</sup> Menge, K.: *Handbuch d. Geschlechtskrankheiten*, Vienna, 1910.

that, on the average honeymoon, the hymen would remain unruptured for the period required for the development of subjective symptoms.

The chronicity of gonorrhea attacking areas below the internal os accounts for many of the peculiarities of the disease, and, prior to the discovery of the gonococcus, proved a stumbling-block to the medical man, causing the greatest confusion regarding the etiology of the condition. It can be readily understood how it is possible for a woman innocently to infect a man. This, however, does apply to the average prostitute, who is always on her guard for symptoms and is usually aware of her condition. It also explains the frequent cases of infection from apparently healthy individuals. No trustworthy evidence has ever been adduced to show that actual immunity to gonorrhea exists in the human species. The frequent cases cited, in which two or more men have had intercourse with an infected woman on the same night, and only one or perhaps two have contracted gonorrhea, must be explained on other grounds. It is quite possible that in some of these instances a douche following the first intercourse has saved all but the first man; personal hygiene, such as washing or urination immediately following, may often prevent infection. It is a well-established fact that a female gonorrheic may transmit infection at one time and not at another. Döderlein<sup>1</sup> states that men in whom the external urinary meatus is large are more likely to contract gonorrhea than are those possessing a small, contracted orifice. The general health of the person exposed, together with the individual susceptibility of the individual, may also play a small part in the question of infection. Lenehan<sup>2</sup> has reported a remarkable case in the man in whom a congenital double urethra was present. The upper and smaller urethra was free from infection, but in the lower a well-marked gonorrheal urethritis was observed.

Coitus with an infected woman soon after her menstrual period is extremely likely to produce infection, whereas the healthy woman is herself especially inceptive to gonorrhea at this time. Indeed, the infectiousness of gonorrhea at the menstrual period had led to the commonly accepted belief, among a certain class of the laity, that the disease may be contracted from a healthy woman by coitus at this time. This peculiarity of the disease may be explained by the congestion of the genital organs which is always present at menstruation, and which results in the liberation, from the tissues, of more abundant flora of gonococci. The diminished acidity of the vaginal secretion which follow the flow not only favors the multiplication of gonococci

<sup>1</sup> Döderlein: Quoted by Küstner: *Lehrbuch der Gynäkologie*, 1904, p. 389.

<sup>2</sup> Lenehan, W.: *Amer. Jour. Urol.*, November, 1912, p. 598.

which are already present, but partially accounts for the peculiar inceptiveness which uninfected women exhibit toward gonorrhea at the menstrual period.

Chronic or, as Luther<sup>1</sup> prefers to designate it, latent gonorrhea, is most likely to evince exacerbations after excesses of any kind or exhausting physical exercise; as a consequence, during the periods following such indiscretions, intercourse with infected individuals is peculiarly likely to be followed by infection. Latent gonorrhea is characterized by the fact that many gonococci are established beneath the surface of the mucosa, but are seldom observed on the surface or in the discharge. A woman with latent gonorrhea may perhaps cohabit with a man for long periods without transmitting the disease. The fact must never be lost sight of that for infection to take place the gonococcus must be brought in contact with the mucous membrane, and that anything which tends to lessen the likelihood of this occurrence decreases the probability of contracting gonorrhea. In the so-called latent cases of gonorrhea the gonococcus appears at times partially to lose its virulence, or the hosts become slightly immune to their own particular organism. This is probably more apparent than real. Nevertheless, such individuals may infect others, or, in some cases, themselves cohabit with infected persons without developing symptoms of an acute attack. These constitute the class of persons, occasionally met with, who seem to be immune to gonorrhea. In chronic gonorrhea the secretions may for a time contain few or no gonococci. This fact is amply borne out by clinical and bacteriologic evidence. A curious feature of gonorrhea is shown by the fact that a husband may infect his wife, and practise abstinence during the course of the treatment of his disease may, upon resuming marital relations be inoculated by her and develop an attack perhaps more severe than his original one, or husband and wife may both suddenly manifest severe symptoms. A lack of knowledge of this peculiarity of the microorganism has frequently led to accusations of infidelity. A curious example of this queer feature of the disease, and one instancing the peculiar latency and chronicity of gonorrhea, came under the author's notice a few years ago: Six weeks after marriage the husband, who was ten years older than his wife, was forced to leave home on an extended trip; upon his return his wife informed him that she had developed a purulent leukorrhea a few days after his departure. The family physician was consulted, and he pronounced the wife's condition to be gonorrhea, the typical organisms being found in smear preparations. On this evidence the husband instituted divorce pro-

<sup>1</sup> Luther: *Monats. f. Geb. u. Gynäk.*, vol. xvii, No. 1, p. 71.

ceedings, based on infidelity. Fortunately, at this period the wife visited a gynecologist, who induced the husband to stay the legal proceedings until after he had been examined by a genito-urinary specialist. Up to this time the husband had denied infection, and, indeed, no subjective or objective symptoms of a chronic gonorrhea could be elicited by any of the ordinary means. Repeated cultures and smears from the urethra were negative, and it was not until deep massage of the prostate had been resorted to that gonococci could be demonstrated. It was only then, when confronted with this incontrovertible evidence of his infection, that the husband could be convinced of his condition. He admitted later that, twenty years previously, when quite a young man, he had suffered from a slight urethral discharge that had appeared after an illicit coitus—the only time in his life, so he stated, that he had had intercourse with a woman other than his wife. In this case both husband and wife were persons of a high degree of veracity and integrity, and there is every reason to believe that their statements were true.

Regarding the persistence of the gonococcus in the prostate, opinions differ. Cohn,<sup>1</sup> Wossidle,<sup>2</sup> and Goldberg<sup>3</sup> believe that the organism is rarely found in this location after two years. On the other hand, Finger,<sup>4</sup> Neisser,<sup>5</sup> and Putzler express a contrary opinion. Sax<sup>6</sup> reports a case in which gonococci persisted in the prostate for fourteen years. MacMunn<sup>7</sup> relates a somewhat similar case in which a man infected his wife fifteen years after contracting gonorrhea; Valentine<sup>8</sup> reports a still more remarkable case, in which a man infected his wife thirty years after his apparent cure, and after having fulfilled his marital relations with her for twenty-four years. Apetz<sup>9</sup> reviews a case of gonorrhea after six years without fresh infection, but with a concomitant outbreak of polyarthritis and metastatic conjunctivitis and other eye complications. Such instances are, however, extremely unusual. Gonorrhea in the female may persist indefinitely, but in the male a course of more than three or four years is extremely rare and should be viewed with suspicion; in the majority of cases a reinfection is more than likely to have occurred. von Notthaft<sup>10</sup> states that it is unusual for gonorrhea to persist in the genital tract in the male for

<sup>1</sup> Cohn: *Cent. f. Krankh. d. Harn- u. Sexualorgane*, 1898, p. 229.

<sup>2</sup> Wossidle: *Die Gonorrhöe des Mannes u. ihre Komplikationen*, Berlin, 1903, p. 206.

<sup>3</sup> Goldberg: *Cent. f. Krankh. d. Harn- u. Sexualorgane*, 1906, vol. xvii, No. 5.

<sup>4</sup> Finger: *Die Blennorrhöe der Sexualorgane*, 1905.

<sup>5</sup> Neisser: *Verhandl. d. Deut. Dermat. Gesellsch.*, Vienna, 1894.

<sup>6</sup> Sax: *Trans. Amer. Urol. Assoc.*, 1909, Brookline, 1910, vol. iii.

<sup>7</sup> MacMunn, J.: *Lancet*, November 24, 1906, p. 1445.

<sup>8</sup> Valentine, F. C.: *Phila. Med. Jour.*, July 8, 1899.

<sup>9</sup> Apetz, W.: *Münch. med. Woch.*, vol. l, p. 1340.

<sup>10</sup> v. Notthaft: *Arch. f. Dermat. u. Syph.*, 1904, vol. lxx, p. 277.



more than three years, and Keyes<sup>1</sup> writes that he has never known the gonococcus to survive in a male host for more than a similar period, and that in at least 90 per cent. of cases they disappear with or without treatment within a year. On the other hand, Pollock and Harrison<sup>2</sup> believe that in a large proportion of cases recovery is not complete.

Husband and wife may cohabit regularly and may both be infected, and yet manifest no subjective symptoms of the disease, whereas a third individual having intercourse with either one may develop an acute attack, or the gonococci of a married pair may be transferred to a third person, and from them to one of the couple, setting up a severe lesion in its original host. These instances are sufficient to show that gonococci may remain latent for prolonged periods, but that when transferred to another individual, are capable of setting up severe inflammation, and may be transferred either through the second or by a third person to the original host, and in the latter produce an acute attack.

Jadassohn<sup>3</sup> has suggested that some chronic gonorrheas may be rendered acute by superinfection with their own gonococci. Gonococci may lie dormant in the genital tract of women for years, becoming active with the advent of pregnancy, miscarriage, or abortion, and then produce sepsis. Women are usually infected by men suffering from chronic urethritis. An old gleet discharge ("morning drop") is one of the most prolific causes of infection. Men so afflicted frequently consider themselves cured, or may actually be told so by some hard-worked physician, who has neither the time nor the knowledge and facilities required to make a thorough examination. On the other hand, a chronic urethritis may be present in the man and produce absolutely no symptoms until a slight excess of alcohol may give rise to a mild exacerbation, at which time the urethral discharge may contain virulent gonococci. The prevalence of gleet is well known, and largely accounts for the frequency of gonorrhea among married women.

**Racial Susceptibility.**—It is difficult to determine if any racial susceptibility to gonorrhea exists. It is commonly asserted that the African race is peculiarly susceptible to gonorrhea. It appears to be a fact that gonorrhea is relatively more frequent among negroes than among whites. What proportion of this can be laid at the door of immorality and uncleanness is impossible accurately to estimate, but this is probably the chief factor. Research has failed to show that gonorrhea is more malignant in new peoples than in those unaccustomed to the disease for generations, and it seems likely that the infection is quite as severe at the present date as it was generations ago.

<sup>1</sup> Keyes: Amer. Jour. Med. Sci., January, 1912.

<sup>2</sup> Pollock, C. E., and Harrison, L. W.: Gonococcal Infection, London, 1912, p. 40

<sup>3</sup> Jadassohn: Correspondenz-Bl. f. schw. Aerzte, May 1, 1898.



## CHAPTER V

### SOCIOLOGY

THE general and wide-spread evil effects of gonorrhea can hardly be overestimated. There is probably no other disease known to medical science that has caused as much suffering and sorrow throughout the civilized world as has gonorrhea. Neisser states that, with the exception of measles, gonorrhea is the most wide-spread of all diseases. It is the most potent factor in the production of involuntary "race suicide," and, by sterilization and abortion, does more to depopulate

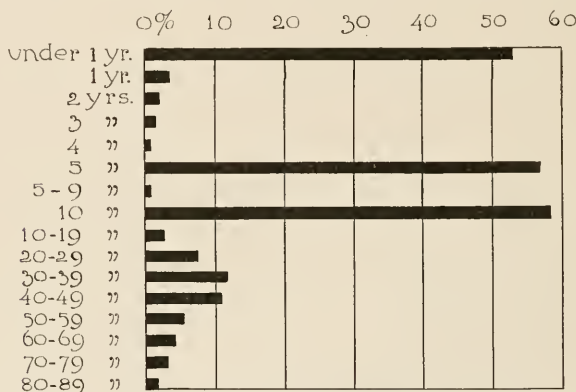


FIG. 27.—AGE DISTRIBUTION OF DEATH FROM VENEREAL DISEASE, PER CENT. (BROWN, H. A.: New York Med. Jour., June 17, 1911, p. 1185).

the country than does any other one cause. The number of deaths annually that can be traced directly to this disease is difficult to estimate, but it is undoubtedly large. The majority of deaths due directly to this disease are usually tabulated under other headings in mortality statistics. An example of this in the recent Mortality Statistics<sup>1</sup> issued from Washington in which, from 1900 to 1909, the average death-rate due to gonorrhea (excluding stillbirth) for both

<sup>1</sup> Mortality Statistics, 1909, Department of Commerce and Labor, Bureau of Census, Washington, 1912, p. 86.

infants and adults is placed at 31 and 32 per 100,000 respectively. These statistics are misleading, as they refer only to the cause of death, as stated in the death certificate, and naturally do not include the vast number of deaths that are directly due to gonorrhea, and that are usually recorded in the death certificate as pelvic abscess, peritonitis, septicemia, etc.

Of the 500,000 prostitutes who constitute a part of the population of our great cities, it is estimated that 40,000 die annually. Of these deaths, 30 per cent. are due to gonorrhea. Among the deaths following abdominal operations a very definite percentage can be traced to this type of infection. Price asserted that 90 per cent. of all pelvic infections are of gonorrheal origin. Norris, whose statistics were compiled from dispensary patients, places the proportion at 80 per cent.; Pozzi and Frederic, at 75 per cent.; Clark, at 50 per cent.; Davis and Noble, at from 5 to 10 per cent.; and Robb,<sup>1</sup> at 25 per cent. Grandin states that 60 per cent. of all gynecologic operations are performed for gonorrhea or its results. Kaan<sup>2</sup> states that in Boston from 5 per cent. to 16 per cent. of all gynecologic operations are performed for gonorrhea. This author believes that many writers place too much stress upon the gonococcus as an etiologic factor in pelvic inflammatory diseases. Kaan's report is, however, based upon clinical findings only, no bacteriologic studies having been performed upon the cases reported by him. Morrow and Bridgman<sup>3</sup> report that in the State Training School for Girls at Geneva, Illinois, approximately 55 per cent. of the inmates have gonorrhea at the time of their entrance. The average number of commitments a year to this school is about 200.

Statistics computed from the reports of Bröse, Sanger,<sup>4</sup> and Eberhard show that in a series of 1361 gynecologic patients, 12.77 per cent. were infected with gonorrhea. From these figures, therefore, placed at a conservative estimate, gonorrhea may be said to cause at least 50 per cent. of all pelvic inflammatory diseases.

The percentage of sterility traceable to gonorrhea is more difficult to estimate. Neisser, Bumm, and Fürbringer state that 30 per cent. to 50 per cent. of all childless marriages are directly caused by gonorrhea. In France statistics have been accurately compiled, and it has been found that, of about 10,000,000 families, 2,000,000 are without issue. These results, according to Neisser, would tend to show

<sup>1</sup> Robb: *Trans. Amer. Gyn. Soc.*, 1906.

<sup>2</sup> Kaan, G. W.: *Boston Med. and Surg. Jour.*, April 11, 1912, p. 559.

<sup>3</sup> Morrow, L., and Bridgman, O.: *Jour. Amer. Med. Assoc.*, May 25, 1912, p. 1564.

<sup>4</sup> Sanger, W. W.: *History of Prostitution*, 1906.

that gonorrhea is the etiologic factor in nearly 1,000,000 sterile marriages in France alone, and this does not include the vast number of "one-child sterilities" due to this condition. Other authorities place the proportion of sterility resulting from gonorrhea at figures varying from 30 per cent. to 50 per cent. Funck-Brentano and Plauchu,<sup>1</sup> in a series of 134 sterile women, found that in 37 the condition was due to gonorrhea. Lobenstine and Harrar<sup>2</sup> found that the average birth-weight of the infants of gonorrheal mothers was lower than of babies of mothers unaffected with this disease. Their conclusions were based on the observation of 150 babies of normal mothers, as compared with 50 babies of afebrile gonorrheal mothers, and 50 babies of gonorrheal mothers with fever. The birth-weight of these infants was lower, the initial loss of weight greater, and the subsequent gain slower, than in babies of non-gonorrheal mothers. These authors consider that, in the late months of pregnancy, gonorrhea is a frequent cause of premature births. Many authors claim that placenta prævia and adherent placenta are often caused by a preëxisting gonorrheal endometritis, but this has not yet been definitely proved. Placed at a low estimate, gonorrhea may be said to cause 20 per cent. of all the blindness in the world. In the United States census for the blind and deaf for 1900 it was shown that ophthalmia neonatorum was the cause of 25.02 per cent. of all the blindness. It has been computed that, in Prussia, venereal diseases cause an annual loss to the State of 90,000,000 marks (\$21,600,000). The Royal Commission on the Blind, the Deaf, and the Dumb, which reported in 1889, estimated that 7000 persons in the United Kingdom had lost their sight as a result of ophthalmia. They state further that the number of people disabled as a result of this condition represents an annual burden to the commonwealth of £350,000. There is every reason to believe that gonorrhea and other venereal diseases are quite as prevalent in this country as in Europe.

**Frequency.**—On account of the secret nature of the malady, the frequency of gonorrhea in civil life is difficult to estimate accurately, and more especially is this the case with gonorrhea in the female. In 1901 the Committee of Seven<sup>3</sup> on Prophylaxis of Venereal Diseases in New York sent out a circular letter to 4750 physicians in New York City asking for data regarding venereal disease. A large number of the hospital and dispensary reports from the same city were also examined. It was estimated by this Committee that at that time

<sup>1</sup> Funck-Brentano, L., and Plauchu, E.: *La Gynecologie*, October, 1912, p. 577.

<sup>2</sup> Lobenstine and Harrar: *Bull. Lying-in Hosp.*, New York, December, 1906.

<sup>3</sup> "Report of the Committee of Seven," *Med. News*, December 21, 1909.

there were 220,000 venereal patients walking the streets of New York. Holton<sup>1</sup> places this number at 200,000. A special committee of the New York Medical Association recently placed the number of venereal patients in New York at the same figure. The large proportion of patients upon whom the statistics for this report were based were males. Reports of 23,196 cases of venereal disease were made by 678 physicians. It is a significant fact that 40 per cent. of all the female gonorrheics suffered from pelvic symptoms.

Gonorrhea attacking the area below the internal os frequently produces only mild symptoms, which are often overlooked by the patient herself, and, as a result, a definite proportion of such women do not go to physicians for treatment. In addition chronic gonorrhea in these localities is not infrequently overlooked by the average physician. It is, therefore, safe to state that many female gonorrheics were overlooked.

In 36 dispensaries and charitable institutions 14,649 cases of gonorrhea and 7607 cases of syphilis, a total of 22,256 cases, were treated during the year. In addition, there were 9452 cases grouped as venereal in which, presumably, a positive diagnosis had not been made, bringing the total to 31,708. This does not include 3907 cases of chancroid, 898 cases of epididymitis, 332 cases of cystitis, 414 cases of bubo, 261 cases of venereal warts, 172 cases of balanitis or phimosis, 523 cases of ophthalmia, 142 cases of ophthalmia neonatorum, 19 cases of vulvovaginitis in children, and 195 cases of hereditary syphilis. Many cases of venereal disease are treated under other names, since some hospitals have rules forbidding the treatment of such cases. Statistics from a number of large institutions were not available to the Committee of Seven. This Committee believed that, to obtain a true estimate regarding the number of venereal patients in New York, their figures should be multiplied by seven. Among 4664 women treated at the Massachusetts General Hospital in 1906, 150 had gonorrhea. These figures are, however, undoubtedly fallacious, owing to the latency and chronicity of gonorrhea in women. It would probably be more accurate to say that 150 of these women suffered from acute gonorrhea.

The following statistics, taken from the Committee on Prophylaxis of Venereal Diseases, Washington State Medical Association,<sup>2</sup> state that 80 per cent. of all men in large cities have had gonorrhea once or several times, 45 per cent. infect their wives, 80 per cent. of all opera-

<sup>1</sup> Holton: Jour. Amer. Med. Assoc., March 11, 1905.

<sup>2</sup> Quoted by R. Guiteras: Urology, D. Appleton and Co., New York and London, 1912, vol. ii.

tions upon women for diseases of the uterus and adnexa are caused by gonorrhea, and that 20 per cent. of all blindness results from the same cause. Menge<sup>1</sup> states that for every five or six cases of gonorrhea in the male there is one in the female. This observer bases his opinion upon the fact that gonorrhea, in the majority of cases, is contracted through illicit intercourse, and that unmarried men are more licentious than unmarried women. On the other hand, it should be remembered that in the male the early symptoms of gonorrhea are of such a character as to demand early treatment, and, as a result, most cases are cured, whereas in women the disease is often so far advanced by the time severe subjective symptoms arise that a complete cure is often extremely difficult. Furthermore, the chronic stage of the disease, when confined to structures below the internal os, is productive of so few symptoms that women frequently neglect treatment. In women, therefore, the disease averages a longer course than in men. Keyes<sup>2</sup> estimates that 50 per cent. of young men contract gonorrhea. Clark<sup>3</sup> places the proportion at 75 per cent., and Weiss<sup>4</sup> at 80 per cent. Neisser<sup>5</sup> states that 75 per cent. of all men and 45 per cent. of all women have had gonorrhea, and that 30 per cent. of the females have been infected by their husbands. Erb<sup>6</sup> found that 48.5 per cent. of all the patients who consulted him had suffered from gonorrhea. His statistics are drawn from 2000 cases. Bettman found that 41 per cent. of the patients in a dermatologic clinic had, at some time in their lives, contracted gonorrhea. His statistics are based upon 241 cases. Yudice, from similar material, found 50 per cent.; Forchheimer<sup>7</sup> found 54.1 per cent. among 258 cases, none of whom were under thirty years of age. These included private patients. Cabot<sup>8</sup> reports that of 8000 male patients questioned in a large general hospital, over 35 per cent. gave a history of having had gonorrhea. Sanger<sup>9</sup> found 230 cases (12 per cent.) of gonorrhea among 1930 women examined by him. Bierhoff<sup>10</sup> estimates that there are in New York today 1,000,000 persons affected with venereal disease. Of this number, 800,000 are

<sup>1</sup> Menge, K: "Die Gonorrhöe des Weibes," Handbuch der Geschlechtskrankheiten, Vienna, 1910.

<sup>2</sup> Keyes, E. L.: Diseases of the Genito-urinary Organs, 1911, p. 97.

<sup>3</sup> Clark, J. B.: Essays on Genito-urinary Subjects, New York, 1912, p. 51.

<sup>4</sup> Weiss, L.: Med. News, September 10, 1904, p. 487.

<sup>5</sup> Neisser: Quoted by Mallowney, J. J.: The China Med. Jour., March, 1912.

<sup>6</sup> Erb: Münch. med. Woch., 1907, No. 31.

<sup>7</sup> Forchheimer, F.: Boston Med. and Surg. Jour., July 30, 1908, p. 161.

<sup>8</sup> Cabot: Boston Med. and Surg. Jour., August 3, 1911.

<sup>9</sup> Sanger: Die Tripperansteckung beim weiblichen Geschlechte, 1889.

<sup>10</sup> Bierhoff: New York Med. Jour., November 12, 1910.

gonorrheics. Gerrish<sup>1</sup> places the number of venereal patients in New York at 800,000. Sanger<sup>2</sup> believed that in 1857 there were 74,000 venereal patients in New York. The population was at that time about 700,000. Morrow<sup>3</sup> states that venereal diseases contribute a sum total of morbidity of nearly double that of all other infectious diseases, both acute and chronic. This observer believes that there are 250,000 married women in the United States infected with gonorrhea. He computes this estimate on a basis of 8 per cent. of infection among married women. This proportion may be too high, as Erb,<sup>4</sup> in a recent paper, places this figure at 4.5 per cent. The apparent discrepancy in these figures may doubtless be partially accounted for by the class of patients from which the statistics are compiled. Gynecologists see more female gonorrheics, and their methods of examination are more thorough than are those of the general practitioner; as a result, they are likely to find a greater proportion of infected patients than those less skilled in methods of examination. Noeggerath estimated 80 per cent. Morrow states that there are 1,500,000 men annually infected with gonorrhea in this country. Seventy per cent. of 1155 cases treated, mostly venereal, at Hot Springs, had at the time of examination, or had previously had, gonorrhea.<sup>5</sup> Hepburn<sup>6</sup> reports that in Baltimore, during 1906, 3090 cases of venereal disease were treated by physicians in private practice, and 6390 cases in dispensaries. During the same year there were treated in Baltimore 575 cases of measles, 1172 cases of diphtheria, 577 cases of scarlet fever, 175 cases of chicken-pox, 58 cases of smallpox, and 733 cases of tuberculosis, making a total of 3310 cases of infectious disease, against a total of 9450 cases of venereal diseases.

The frequency of gonorrhea naturally varies in different walks of life and under different conditions. Stephenson<sup>7</sup> has computed the statistics for the following table:

CONDITION	NUMBER OF CASES	PERCENTAGE OF GONORRHEA
Puerperal infection.	354	14.763
Pregnant women.	1,101	18.430
Married women with fluor albus.	65	26.430
Loose women with fluor albus.	278	33.810

<sup>1</sup> Gerrish: *Social Diseases*, 1911, vol. ii, No. 2.

<sup>2</sup> Sanger, W. W.: *The History of Prostitution*, 1906.

<sup>3</sup> Morrow: *Maryland Med. Jour.*, 1908, p. 260.

<sup>4</sup> Erb: *Münch. med. Woch.*, 1907, No. 31.

<sup>5</sup> *The Social Evil in Chicago*, 1911, p. 298.

<sup>6</sup> Hepburn: *Yale Med. Jour.*, 1908, p. 168.

<sup>7</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 38.

Luther<sup>1</sup> states that in two large gynecologic dispensaries in Philadelphia 25 per cent. of the patients suffered from venereal disease. Bailey<sup>2</sup> believes that 75 per cent. of the male and 17 per cent. of the female population have at some time had gonorrhea. Schwartz<sup>3</sup> has calculated that 10 per cent. of married men enter wedlock afflicted with chronic gonorrhea, and that an additional 10 per cent. acquire gonorrhea during married life. Some continental authorities compute that 75 per cent. of all male adults and 18 per cent. of all females have suffered from gonorrhea. Ivens<sup>4</sup> found gonorrhea in 24 per cent. of his gynecologic patients. Blaschko,<sup>5</sup> reporting the statistics from Copenhagen from 1876-95, finds that 12.8 per cent. of the population have gonorrhea. He also found that, among 600 students in Berlin in 1891-92, 18.5 per cent. had gonorrhea, and that 20 per cent. of all men are infected with this disease once between twenty and thirty years of age. According to Emley,<sup>6</sup> 15 per cent. of all patients in the Paris hospitals, 10 per cent. in all the New York hospitals, and 33 per cent. in all the London hospitals, have suffered from venereal disease. Swarts<sup>7</sup> states that 70 per cent. of all women who come to New York hospitals for treatment of venereal diseases are reputable married women who have been infected by their husbands; that in New York there are annually 12,500 cases of measles, 11,000 cases of diphtheria, and about 19,000 of tuberculosis—in round numbers, 41,000 cases of infectious disease. During the same period there are 243,000 cases of venereal disease. Litchfield<sup>8</sup> estimates that in Berlin there are annually infected with venereal disease 4 or 5 per cent. of the soldiers, 13 to 30 per cent. of waitresses, 16.5 per cent. of salesmen, and 25 per cent. of students. According to the canvass completed in April, 1910, there are in Germany on an average 100,000 persons treated daily for venereal disease. Of about 12,000,000 persons insured in the German Empire, about 750,000 are annually infected with some form of venereal disease. From data estimated by the Prussian government<sup>9</sup> it has been stated that at least 500,000 persons were infected with a venereal disease yearly. Another, and later, authority<sup>10</sup>

<sup>1</sup> Luther, J. W.: *The Pennsylvania Med. Jour.*, July, 1912, p. 192.

<sup>2</sup> Bailey: *Boston Med. and Surg. Jour.*, June 5, 1902.

<sup>3</sup> Schwartz, E., quoted by L. Weiss: *Second Annual Report of the Committee on Prophylaxis of Venereal Diseases of the Amer. Med. Assoc.*, *Jour. Amer. Med. Assoc.*, June 30, 1904.

<sup>4</sup> Ivens: *Brit. Med. Jour.*, June 19, 1909.

<sup>5</sup> Blaschko, A.: *Syphilis und Prostitution vom Standpunkte der öffentlichen Gesundheitspflege*, Berlin, 1893.

<sup>6</sup> Emley: *Kansas Med. Soc.*, 1908, p. 428.

<sup>7</sup> Swarts: *Report of State Sanitary Officers*, 1910.

<sup>8</sup> Litchfield: *Jour. Social Hygiene*, December, 1909, p. 174.

<sup>9</sup> *Hygienische Rundschau*, April, 1902.

<sup>10</sup> Quoted by Kean, J. R.: *Military Surgeon*, March, 1912, p. 251.



places this figure at 773,000. Of this mass of statistical evidence, much of which varies quite widely, the greatest stress should be placed on the figures computed by the Committee of Seven on Prophylaxis of Venereal Diseases in New York. The report of this Committee shows the result of careful work, and an entire absence of any desire either to overestimate or underrate the conditions found.

All statistics taken from civil life are, however, for obvious reasons, more or less inaccurate. In the army and navy a different condition of affairs exists. Here the men are subject to frequent systematic medical examination, hence the statistics derived from these sources are undoubtedly more reliable. It has been asserted that venereal disease is more prevalent in the army and navy than in civil life. This is probably not the case if such reports are compared with statistics composed of men of similar age in civilian life. Von Tophy states that the relative venereal morbidity in armies bears a close relationship to the prevalence of this class of diseases among the civilians in the district in which they are quartered. Munson gives the following figures relative to the prevalence of venereal disease per 1000 in armies;

Germany	29.9
Russia	36.0
Japan	40.0
Holland	48.0
France	49.0
Austria-Hungary	60.0
Great Britain (home statistics)	173.8
" " (foreign " )	522.3
United States	73.7

In 1909 the rate of admission for venereal disease in the following armies was:

British	97.04
Austria-Hungary	60.00
French	29.08
Prussian	19.08
Bavarian	14.00

From the foregoing it will be seen that venereal diseases are extremely prevalent in the United States army. For eighteen years preceeding the Civil War the morbidity of venereal disease was 87.86 per 1000. From 1876 to 1895 inclusive the rate was 82.98, decreasing from 107.6 in 1876 to 73.7 in 1895. During this period there was a steady decrease in the number of cases of syphilis. In decennial annual periods from 1868 to 1897 the annual rate of syphilis was 67.20, 36.45, and 15.63. On the other hand, the rate of gonorrhea, though decreasing up to 1885, showed a constant increase thereafter, it being 37.76 in 1885 and 56.21 in 1897. In 1901, in the entire army (92,491

men), there were 13,911 cases of venereal disease, equivalent to a ratio, on admission, of 150.41 per 1000—for syphilis, 19.15, and for gonorrhea, 93.90.

ADMISSION RATE FOR VENEREAL DISEASE IN THE ENTIRE UNITED STATES ARMY

YEAR	VENEREAL RATE	SYPHILIS	GONORRHEA	CHANCROID
1899	133.00	13.98	80.23	39.79
1900	133.97	15.83	78.69	39.45
1901	150.41	19.15	93.90	37.36
1902	160.94	22.37	106.58	31.99
1903	151.48	23.42	96.14	31.92
1904	188.34	33.98	120.97	33.39
1905	198.93	34.34	131.30	33.29
1906	190.46	28.60	124.65	37.21
1907	191.62	28.92	123.30	44.40
1908	194.15	26.40	135.56	32.19
Total . . . . .	1,698.30	246.99	1,091.32	359.99
Average . . . . .	169.83	24.70	109.13	36.00

ADMISSION RATE OF VENEREAL DISEASE IN THE ARMY QUARTERED IN THE UNITED STATES

YEAR	VENEREAL RATE	SYPHILIS	GONORRHEA	CHANCROID
1899	127.28	13.49	87.29	26.57
1900	133.98	19.62	102.42	33.35
1901	149.96	19.35	104.21	26.40
1902	161.14	23.03	108.54	29.57
1903	135.84	23.64	84.09	28.11
1904	163.42	28.47	107.05	27.90
1905	176.72	30.02	118.31	30.39
1906	158.91	27.28	105.21	26.41
1907	167.82	25.26	107.68	37.78
Total . . . . .	1,377.06	210.26	924.80	263.48
Average . . . . .	153.01	23.36	102.78	29.28

Grubbs<sup>1</sup> presents the following table, showing the prevalence of venereal disease in the United States army in various localities, and comparing it in frequency with the diseases next most prevalent:

RATIO PER 1000 OF STRENGTH

DISEASE	UNITED STATES, INCLUDING PORTO RICO	ALASKA	CUBA	HAWAII	PHILIPPINE ISLANDS
Venereal disease . .	167.82	55.49	152.39	223.96	311.22
Malaria . . . . .	30.20	1.18	51.40	None	167.79
Diarrhea and enteritis . . . . .	39.39	1.18	77.55	46.67	72.48

<sup>1</sup> Grubbs: The Military Surgeon, 1909, p. 576.

The Surgeon General of the United States army, in his report for the year 1904, states that venereal diseases held first place in admissions to hospitals, and caused more discharges and rendered more men non-efficient than any other single factor. During 1904 venereal diseases caused 19 per cent. of all admissions to hospital, 15 per cent. of all discharges, and 30 per cent. of all non-efficiency because of disease. Seven hundred and ten men were constantly on the sick list for venereal diseases; a number equal to the loss for the entire year of about eleven full companies of infantry.

TABLE SHOWING MOVEMENT OF VENEREAL DISEASE IN THE UNITED STATES NAVY, 1880-1909

YEAR	MEAN STRENGTH, NAVY AND MARINE CORPS (MEDICAL RETURNS)	ADMISSION FOR GONORRHEA	AGGREGATE PRIMARY INFECTIONS OF ALL VENEREAL DISEASES	ADMISSION RATE PER 1000 FOR ALL PRIMARY INFECTIONS	CASES	
					PERCENTAGE	ONE IN X MEN
1880..	9,003	212	725	81.64	0.022	42.46
1881..	9,546	213	724	75.85	0.022	44.81
1882..	9,371	216	819	87.40	0.023	43.38
1883..	9,197	252	685	74.48	0.028	36.49
1884..	9,959	298	799	80.23	0.029	33.41
1885..	9,191	370	830	90.31	0.040	24.84
1886..	9,188	389	869	94.58	0.042	23.62
1887..	9,618	396	807	83.90	0.041	24.29
1888..	9,956	348	872	87.59	0.035	28.61
1889..	11,219	316	744	66.32	0.028	35.50
1890..	11,768	286	694	58.97	0.024	41.15
1891..	11,501	284	582	50.60	0.023	40.50
1892..	11,775	329	614	52.14	0.027	35.79
1893..	12,109	304	535	44.18	0.025	39.83
1894..	12,520	501	981	78.36	0.040	24.99
1895..	12,671	330	721	58.48	0.026	38.40
1896..	13,768	303	673	47.43	0.022	45.44
1897..	15,229	323	729	47.87	0.021	47.15
1898..	23,038	503	1,076	46.71	0.021	45.80
1899..	20,113	517	1,149	57.13	0.025	38.86
1900..	22,977	525	1,204	52.40	0.022	43.77
1901..	26,101	617	1,380	52.87	0.023	42.30
1902..	30,249	771	1,661	54.91	0.025	39.23
1903..	36,536	1,032	2,244	61.42	0.028	35.40
1904..	39,450	1,512	2,934	74.04	0.038	26.09
1905..	39,620	2,085	3,609	91.38	0.052	19.00
1906..	41,690	2,640	4,520	108.42	0.063	15.79
1907..	44,038	2,274	3,709	84.14	0.051	19.37
1908..	50,984	3,015	4,681	91.81	0.059	16.91
1909..	55,550	5,861	8,910	160.40	0.105	9.49

Fiske<sup>1</sup> states that one man in every seven in the navy develops a venereal infection each year. (Table by Kean.<sup>2</sup>)

<sup>1</sup> Fiske: Jour. Amer. Pub. Health Assoc., March, 1911, p. 181.

<sup>2</sup> Kean, J. R.: The Military Surgeon, March, 1912, p. 251.

ADMISSION.—TOTAL VENEREAL RATIO PER 1000 OF MEAN STRENGTH,  
REGULAR TROOPS, UNITED STATES ARMY CASES

YEAR	UNITED STATES	PHILIPPINES	TOTAL ARMY
1880	97	..	..
1881	92	..	..
1882	78	..	..
1883	77	..	..
1884	75	..	..
1885	80	..	..
1886	72	..	..
1887	74	..	..
1888	80	..	..
<sup>1</sup> 1889	85	..	..
<sup>1</sup> 1890	75	..	..
<sup>1</sup> 1891	72	..	..
<sup>1</sup> 1892	77	..	..
<sup>1</sup> 1893	73	..	..
<sup>1</sup> 1894	80	..	..
<sup>1</sup> 1895	74	..	..
<sup>1</sup> 1896	78	..	..
<sup>1</sup> 1897	85	..	..
<sup>1</sup> 1898	81	..	..
<sup>1</sup> 1899	138	156	146
<sup>1</sup> 1900	155	139	159
1901	150	155	157
1902	161	156	161
1903	136	175	151
1904	148	297	188
1905	157	306	200
1906	144	310	190
1907	149	311	197
1908	155	290	194
1909	151	302	197
1910	138	276	175

Munson<sup>2</sup> states that among all troops venereal diseases are always more prevalent when on foreign service. He also believes that venereal diseases are more severe in tropical climates, and when sexual relations are assumed between individuals of different races, the aliens suffering more in this respect than the resident population. In this connection Kean<sup>3</sup> gives the following figures regarding the respective races serving side by side in the Philippine Islands for the last quinquennium:

YEAR	WHITE	COLORED	FILIPINO
1905	306	None in P. I.	60.0
1906	309	322	63.2
1907	277	494	63.5
1908	267	388	56.0
1909	290	418	49.0

<sup>1</sup> Establishment of canteen, February 1, 1889. February 21, 1901, Act of Congress prohibiting sale of alcoholic drinks in canteen.

<sup>2</sup> Munson: "Camp Diseases," Handbook of Medical Sciences, Wm. Wood and Co., vol. ii.

<sup>3</sup> Kean: The Military Surgeon, March, 1912, p. 251.

The explanation of this astonishing difference is that the native troops are mostly married, a reason that probably applies also to native troops of other countries.

Kerr<sup>1</sup> states that of 1,281,472 cases treated in the United States Public Health and Marine-Hospital Service between 1886 and 1909, 263,215, or 20.5 per cent., were of venereal origin. The Surgeon General of the United States navy, in a recent report, states that venereal diseases constitute the gravest menace to the physical efficiency in that service. The five-year period from 1904 to 1908, with an average of 43,165 men in the navy and marine corps, shows a total number of admissions for venereal and genito-urinary disease of 32,852, of which number 11,526 were suffering from gonorrhea and 4890 from syphilis. The Surgeon General also states that these figures are far short of the actual number, as it was formerly the custom of many surgeons to report only such patients as were incapacitated by their disease. In 1909 the total primary admissions for all diseases were 38,735, of which number 11,064 were venereal patients. Gates believes the prevalence of venereal disease in military service to be about the same as that existing in private life among young unmarried men. Mummery<sup>2</sup> reports that in the British navy venereal disease is not diminishing. He states that in 1906, in a total force of 108,190 men, 13,193 suffered from venereal disease. During the year there was a total number of days' loss to the service of 316,631. The daily number rendered inefficient because of venereal disease was 867.46.

The table supplied by Lieutenant-Colonel J. R. Kean,<sup>3</sup> of the Medical Department of the United States army, and Surgeon C. N. Fiske,<sup>3</sup> of the United States navy, to the Committee on Education of the Public to the Communicability and Prevention of Syphilis and Gonorrhea, shows the following data:

	YEAR	GONORRHEA	CHANCROIDS	SYPHILIS	TOTAL VENEREAL DISEASE
United States army . . .	1909	135.77	30.77	30.45	196.99
United States navy . . .	1909	105.11	28.23	26.29	160.40
Japanese navy . . . . .	1907	..	..	..	139.75
British navy . . . . .	1908	67.16	17.46	37.46	122.49
British army . . . . .	1908	40.70	28.23	35.10	75.80
Spanish army . . . . .	1907	28.40	27.84	11.60	67.80
German navy . . . . .	1908	36.40	9.50	17.30	63.20
Russian army . . . . .	1907	30.20	12.20	17.70	60.10
Austrian army . . . . .	1907	28.10	10.10	16.00	54.20
Japanese army . . . . .	1907	17.10	10.40	10.10	37.60
Belgian army . . . . .	1907	19.99	..	6.20	26.10
Dutch army . . . . .	1905	17.00	..	4.60	21.60
Prussian army . . . . .	1907	12.20	2.10	4.40	18.70
Bavarian army . . . . .	1907	10.90	0.97	3.30	15.10

<sup>1</sup> Kerr: Jour. Amer. Pub. Health Assoc., March, 1911, p. 192.

<sup>2</sup> Mummery: Brit. Med. Jour., August 15, 1908, p. 394.

<sup>3</sup> Kober, G. M.: Jour. Amer. Pub. Health Assoc., March, 1911, p. 164.

This Committee, in commenting on these statistics, states that, in its opinion, the high percentage of venereal diseases occurring among the English-speaking races is largely the result of the lax attitude adopted toward prophylaxis against these diseases in both England and the United States.

Kean<sup>1</sup> quotes the following figures as the admission rates given in the reports last obtainable for the important navies of the world:

	YEAR	MEAN STRENGTH	RATE PER 1000
German.....	1907-8	49,955	66.0
French.....	1905	49,935	75.0
Italian.....	1906	27,338	83.0 <sup>2</sup>
Japanese.....	1908	43,857	167.0
British.....	1909	112,700	120.0
American.....	1909	57,172	160.0

Kean<sup>3</sup> presents the following tables, showing the prevalence of venereal disease in the French, Austro-Hungarian, Spanish, and Russian armies:

## FRENCH

YEAR	GONORRHEA	SYPHILIS	CHANCROID	TOTAL
1903.....	19.20	5.90	1.90	27.0
1904.....	21.10	6.60	2.10	29.8
1905.....	19.80	7.00	2.30	29.1
1906.....	19.00	7.30	2.30	28.6
1907.....	18.35	6.75	2.73	27.8

## AUSTRO-HUNGARY

YEAR	GONORRHEA	SYPHILIS	CHANCROID	TOTAL
1903.....	30.1	19.2	9.6	58.9
1904.....	31.8	19.3	10.5	61.6
1905.....	29.0	20.1	10.9	50.0
1906.....	30.1	19.2	11.3	60.6
1907.....	28.1	16.0	10.1	54.2

## SPANISH

YEAR	GONORRHEA	SYPHILIS	CHANCROID	TOTAL
1903.....	923.64	12.17	27.56	63.37
1904.....	23.05	10.43	28.65	62.13
1905.....	20.42	9.42	27.95	57.79
1906.....	27.27	8.79	27.34	63.40
1907.....	28.41	11.64	27.84	67.89
1908.....	38.20	13.66	40.76	92.66

<sup>1</sup> Kean, J. R.: Military Surgeon, March, 1912, p. 261.

<sup>2</sup> This is the figure given in the official reports for "Malattie veneree." "Malattie sifiliche" is given separately, with a rate of 24 per 1000. It is not clear, from this context, whether the latter should be added to the former or is included in it.

<sup>3</sup> Kean, J. R.: *Loc. cit.*

## RUSSIAN ARMY, MEAN STRENGTH, 1,279,051 MEN

YEAR	TOTAL VENEREAL RATE
1904	44.7
1905	59.2
1906	62.7
1907	60.1
1908	54.3

Although the statistics from army and navy reports refer only to men, there can be little doubt but that they bear a close relationship to the prevalence of gonorrhea among women in the localities in which the troops are quartered.

**Source of Infection.**—The question of the source of infection is one of great importance to those interested in the moral or social prophylaxis of venereal diseases. Numerous statistics have been compiled, and arguments, based on such findings, offered. In studying these statistics it should always be borne in mind that in different countries, and in different periods, many different customs and laws prevail, thus naturally affecting the results of such reports. Probably the most accurate and recent statistics referring to the source of infection among gonorrheal cases in this country are those compiled by Bierhoff.<sup>1</sup> They are computed from cases of venereal disease occurring in New York, and only those cases that could accurately state the source of infection are included in the tables. The diagnosis in each case was based upon the microscopic or bacteriologic demonstration of the gonococcus:

TABLE 1.—SOURCE OF GONORRHEA IN 1429 CASES. MATERIAL DERIVED FROM PRIVATE PRACTICE AND FROM THREE DISPENSARIES

	FIRST INFECTION	LATER INFECTION	TOTAL
Puella publica (street)	213	273	486
" " (brothel)	166	273	439
" " (kept)	9	52	61
" " (unclassified)	6	18	24
" " (friend)	20	22	42
" " (mistress)	4	0	4
Wives (who infected husbands)	20	25	45
Married women and widows	6	38	44
Divorces	1	8	9
Fiancée	1	0	1
Workingwomen and servants	70	166	236
Respectable (living with parents)	7	25	32
School-girls	2	1	3
Sexual perverts	2	1	3
Totals	527	902	1,429

From the foregoing it will be seen that, in 418 cases, or 79 per cent., of all first infections, the infection had its source in a prostitute.

<sup>1</sup> Bierhoff: New York Med. Jour., November 12, 1910.



TABLE 2.—STATISTICS COMPILED FROM PRIVATE PATIENTS.—(*Bierhoff*.)

	FIRST INFECTION	LATER INFECTION	TOTAL
Puella publica (street . . . . .)	30	69	99
“ “ (brothel) . . . . .	42	149	191
“ “ (kept) . . . . .	8	48	56
“ “ (unclassified) . . . . .	6	18	24
Wives (who infected husbands) . . . . .	5	9	14
Married women . . . . .	1	26	27
Divorcées . . . . .	1	8	9
Widows . . . . .	2	3	5
School-girls . . . . .	1	0	1
Respectable (living with parents) . . . . .	4	22	26
Workingwomen:			
Actresses . . . . .	3	53	56
Servants . . . . .	2	3	5
Shop-girls . . . . .	1	8	9
Factory girls . . . . .	1	0	1
Stenographers . . . . .	1	6	7
Hair-dressers . . . . .	1	0	1
Manicures . . . . .	0	3	3
Authors . . . . .	0	2	2
Trained nurses . . . . .	0	3	3
Buyers . . . . .	0	4	4
Private secretaries . . . . .	0	2	2
Cloak models . . . . .	0	3	3
Artist's models . . . . .	0	2	2
Milliners . . . . .	0	5	5
Seamstresses . . . . .	0	3	3
Business-women . . . . .	0	1	1
Cashiers . . . . .	0	1	1
Companions . . . . .	0	1	1
Waitresses . . . . .	0	1	1
Unclassified . . . . .	7	9	16
Totals . . . . .	116	462	578

From Table 2 it will be observed that, in private practice, 370 cases, or 64 per cent., of patients received their infection from prostitutes. Of a total of 1429 cases of gonorrhea, 1056, or 74 per cent., received their infection from public prostitutes. The following table shows the results obtained by Fournier in Paris and Bierhoff in Berlin and in New York as to the source of infection.

TABLE 3

	FOURNIER (Paris, 1866)	BIERHOFF (Berlin, 1899-1900)	BIERHOFF (New York, 1910)
Public prostitutes . . . . .	12	} 87	1,056
Clandestine . . . . .	44		
Mistresses, actresses . . . . .	138		
Workingwomen . . . . .	126	26	Mistresses, { 4a
Servants . . . . .	41	9	Actresses { 57b
Married women . . . . .	26		236
Fiancées, widows, and di- vorcées . . . . .	0	10	61e
Respectable women . . . . .	0	0	45d
School-girls . . . . .	0	0	3
Totals . . . . .	387	132	1,426e

(a) Under prostitute. (b) Under workingwomen. (c) Under workingwomen (d) Own wives. (e) Sexual perverts not included.

The report of the Committee of Seven shows that, in cases in which the source of infection could be traced, 8053 were from public prostitutes, whereas 3915 were from clandestine alliances. The report also states that there were 988 cases of marital infection, seemingly indicating that nearly 33 per cent. of all venereal diseases found in private practice among women were communicated by the husband. In certain quarters it is believed that venereal disease comes as a form of punishment for sin. Every year thousands of innocents, usually wives, are infected. Statistics regarding venereal disease are notoriously inaccurate. Nevertheless, such carefully computed reports as those just quoted cannot fail to impress an unbiased mind with the fact that the public prostitutes in the city of New York today are by far the most prolific disseminators of venereal disease.

Menge<sup>1</sup> states that in Germany, where public prostitutes are under supervision, gonorrheal infection from this source is rather uncommon, but that the clandestine prostitute is a prolific disseminator of the disease. Blaschko<sup>2</sup> found, in 100 cases of gonorrhea in the male, that 80 per cent. had contracted their infection from prostitutes. Düring<sup>3</sup> is of the opinion that the prostitute is the most frequent source of infection. Neisser<sup>4</sup> states that nearly all cases of gonorrhea can be ultimately traced to prostitution. Finger<sup>5</sup> and Lesser<sup>6</sup> are of a similar opinion.

**General Prophylaxis.**—The prevalence and ravages of venereal disease are, at the present time, so great as urgently to require the grave consideration of every physician and every student of sociology.

There is no disease to which the axiom that "prevention is better than cure" applies more forcibly than to gonorrhea. Every gonorrheic is a source of danger: a danger far greater than accompanies the individual affected with an ordinary infectious disease, for the latter is confined to his house, if not by the severity of his disease, at least by law, during the period of his infectiousness. Gonorrheics, on the contrary, mingle with their fellow-men, and thus often establish a sort of endless chain of infection.

The prophylaxis of venereal disease is a subject that is approached by most medical men with a degree of repulsion. Apart from the moral aspects that immediately present themselves, there is a general feeling that such subjects are best not discussed, and that, under any cir-

<sup>1</sup> Menge, K.: *Handbuch der Geschlechtskrankheiten*, Vienna, 1910.

<sup>2</sup> Blaschko, A.: *Syphilis und Prostitution vom Standpunkte der öffentlichen Gesundheitspflege*, Berlin, 1893.

<sup>3</sup> Düring: *Prostitution und Geschlechtskrankheiten*

<sup>4</sup> Neisser: *Mitteilungen d. Gesellschaft für die Bekämpfung der Geschlechtskrankheiten.*

<sup>5</sup> Finger: *Blennorrhöe der Sexualorgan.*

<sup>6</sup> Lesser: *Charité Vorträge.*

cumstances, venereal disease affects chiefly the guilty. This view is particularly prevalent among the English-speaking races. As a consequence we have, in this country, the sorry spectacle of our boards of health ignoring a large and important group of diseases that are well known to be contagious and a menace to public and private health, and well recognized as one of the most potent factors in the production of race suicide. The explanation for this laxity will probably be found to rest on the difficult moral problems presented in this field of prophylaxis, and on the absence of any certain specific method that would offer fair prospects of success. The double standard of morals is a strong factor in the production of venereal disease, but as the woman, in the event of pregnancy occurring, will always be the one to bear the outward and visible signs of her unchastity, there seems little likelihood of a change taking place in this respect.

The subject of the prevention of venereal disease may be grouped under three broad headings: (1) General prophylaxis for those not infected; (2) the method of dealing with prostitution; and (3) the method of dealing with those already infected. There can be no doubt in the minds of all thinking persons that of all methods of dealing with this difficult and urgent problem, education offers the best, broadest, and most hopeful means of securing eventual success. Owing to the secret nature of venereal disease, this can best be accomplished in the hands of a broad-minded educational board, such, for example, as the American Medical Association. The prevalence and ravages of venereal disease are not known to the general lay public, in whose minds this group of diseases, and gonorrhea especially, is often regarded as a comparatively mild lesion. If their extent and harmful influence were generally recognized, a great step in advance in dealing with these conditions would be made, and the physician sought more readily for instruction and aid. Christian,<sup>1</sup> in a recent paper read before the Section on Surgery of the Medical Society of the State of Pennsylvania, rather questions the advantages to be derived from this form of prophylaxis. One example will be sufficient to prove the fallacy of such a view. Few, if any, men would have intercourse with a woman known to have gonorrhea or syphilis. Statistics have amply demonstrated that a large proportion of public prostitutes are affected with a venereal disease of some kind. It would be conservative to state that 50 per cent. of all public prostitutes in the United States were the incumbents of an uncured venereal disease. The majority of these are chronic cases, and do not by any means always transmit their infection to their partners. Nevertheless, few individuals would care to jeopardize

<sup>1</sup> Christian, H. M.: *The Pennsylvania Med. Jour.*, July, 1912, p. 788.

themselves were they truly cognizant of the fact that one out of every two inmates of houses of ill-fame was affected with a communicable disease. Too often such information is considered by men as emanating from a moral, rather than an actual, cause, and it is believed to be an exaggeration, and, therefore, is disregarded. Bigelow<sup>1</sup> writes that sex education will not enforce universal morality in conformity with our accepted code, but it will help in many decisive battles with sex instinct. To all those who see nothing in the movement because it will not solve all the sex problems that have created a demand for special instruction, he replies by pointing out that general education makes more efficient and better citizens, but also often fails.

The age of consent is an important matter in the prophylaxis of venereal disease. In many States the fixed age is too young. In Georgia and Mississippi the age of consent is ten years; in 7 other States it is fourteen years; in Texas, it is fifteen years; in Illinois and in 21 other States, it is sixteen years—thus the average age of consent in 32 states is sixteen years or under. All high school children should receive instruction regarding venereal disease; in many States this is now included under the heading of general hygiene. With a little circumspection such instruction can be shorn of all objectionable features. The exact age at which children should receive this instruction is a point to be carefully considered.

Boys of thirteen or fourteen and girls a year or two older should certainly have some knowledge of sex hygiene, and it would be a distinct advantage for them to obtain such knowledge from a reliable source, rather than to depend on the present method of obtaining a scattered and distorted view from older children or even more harmful sources. It is probable that such institutions as the Red Cross Society in this country, and the First Aid Instruction in England, could be utilized with advantage to teach children the necessary facts regarding venereal disease. Lectures to boys and girls should, of course, be given separately, the boys receiving their instruction from a male and the girls from a female teacher. Such work has already been begun in this country. Morrow<sup>2</sup> states that a collective investigation which is now in progress, but not yet completed, undertaken by a committee of the National Educational Association, shows that, in 138 schools and colleges in the United States, personal and sex hygiene is taught systematically.

Education along broad lines could also be given as a part of each college curriculum. In this connection it is interesting to observe that

<sup>1</sup> Bigelow, M. E.: *Jour. Amer. Med. Assoc.*, October 5, 1912, p. 1312.

<sup>2</sup> Morrow, P. A.: *New York Med. Jour.*, March 23, 1912, p. 577.

this step has already been taken in Austria. Some years ago the students, on entering an Austrian university for the first time, were handed a leaflet containing, in clear and instructive language, warnings against imprudence in sexual intercourse, and explaining the dangers of gonorrhea and syphilis, both to the affected subject and to the wife and offspring. The next step in advance consisted in the instruction of the student before he entered the university. In the higher classes of the preparatory schools, in which the pupils were between sixteen and eighteen years of age, teaching of anatomy gave a good opportunity for scientific instruction on this point. At present the instruction on sexual subjects is given by the school physician, who uses his discretion as to age at which it shall be begun. As a rule, such instruction is given when the pupils are about fourteen years of age.

Lectures, preferably illustrated by lantern-slides, should be delivered to various business and workmen's associations, unions, and large industrial institutions. Great care should be exercised to have such lectures free from all moral teaching and the expression of virtuous platitudes. The audience should be told that continence is entirely compatible with health, and the dangers and prevalence of venereal disease should be dwelt upon. The Young Men's Christian Association would be a vehicle of great aid in the advancement of such an educational cause. If a campaign of this kind were waged by some world-wide educational body, such as, for example, the American Medical Association, various periodicals could be utilized, and would be of the utmost benefit as disseminators of knowledge. Personal hygiene, exercise, and cleanliness should be encouraged. There is no doubt that a certain class of modern literature and art, together with questionable plays, form a very decided detrimental factor in personal morality. The Board of Censors recently instituted in England is doing good work along this line. That the importance of sexual education is recognized in Germany is instanced by the prominence given to this subject in the Internationale Hygiene Ausstellung in Dresden, of 1911.

The intermingling of the sexes as the result of the modern trend of business life is detrimental to the morality of women. Other important factors tending toward sexual impurity, and therefore toward the propagation of venereal disease, are certain economic problems—the influence of crowding, labor competition, faulty home environment, migration to cities, child labor, ignorance, and inadequate moral training. The advertising of unlicensed practitioners of medicine, the patent medicines, the baby-farms, massage establishments, and the abortionists, all have an undermining influence on public

morals. All these factors must be taken into consideration in attempting to reduce the prevalence of venereal disease. Many of these are insignificant in themselves, but when taken together, are of the utmost importance. Sane educational pamphlets are also of value in teaching the public the dangers of venereal disease. The educational problem is so large a one that it could be handled with any degree of effectiveness only by the appointment, by some leading body, of a number of committees. Wolbast<sup>1</sup> has suggested a Committee on High Schools, a Committee on Workingmen and Women's Labor Unions, and like organizations, a Committee on Army and Navy, a Committee on Shops and Factories, a Committee on Churches and Religious Bodies, a Committee on Young People's Clubs and Settlement Houses, and a Committee on Fraternal Orders. Such committees could undoubtedly do much good. We think, however, that the army and navy are quite competent to handle their own affairs. A Committee on Publication would, without doubt, be of great advantage. Physicians could also become valuable disseminators of knowledge. Since the organization, in February, 1905, of the American Society of Sanitary and Moral Prophylaxis, much praiseworthy work along educational lines has been accomplished, a detailed description of which is given by Morrow.<sup>2</sup> Branch societies have been established in Philadelphia, Detroit, Chicago, Milwaukee, Jacksonville, Indianapolis, Baltimore, St. Louis, Spokane, Portland, Denver, and many other cities. In Germany the Association for the Prevention of Venereal Disease, of which Professor Neisser is the President, has accomplished much good in this way. This society numbers over 5000 members, and has distributed over 5,000,000 pamphlets. National organizations for the prevention of venereal disease also exist in France, Austria, Denmark, Italy, Hungary, and Belgium. The oldest organization is the Teleia (literally translated, meaning "Venus"), of Budapest, which is fifteen years old. Sweden has no organization, but the physicians have accomplished much in the way of education by the distribution of pamphlets. It has been claimed by the opponents of educational prophylaxis that it is inefficient, and the statement has been made that venereal disease is prevalent among medical students, a class of young men who are comparatively well educated regarding venereal disease. No proof has, however, been adduced to show that this is so. As a matter of fact, venereal disease among medical students is comparatively infrequent, and even if it were not, this would be no argument against education. The history of medicine shows that all great steps

<sup>1</sup> Wolbast: *Med. and Surg. Jour.*, September 13, 1908, p. 280.

<sup>2</sup> Morrow, P. A.: *New York Med. Jour.*, March 23, 1912, p. 577.



in the prophylaxis against disease have been accomplished along educational lines. As examples of this may be mentioned tuberculosis and yellow fever. Perhaps, however, the greatest cause of lapse from virtue on the part of the average young man or woman is alcohol, and the law regarding the selling of this to minors should be strictly enforced. It is a well-known fact that a large proportion of men are under the influence of alcohol when they become infected. Alcohol in any form, and especially in the young, tends to weaken the moral fiber, to break down natural restraints and barriers, and to cause forgetfulness or disregard of the dangers of illicit intercourse. The cafés and saloons that cater to this class of trade should receive rigid supervision, and any infringement of the present law should be severely dealt with. These places—and they are numerous in all large cities—are direct factors in the production of inestimable harm and the ruin of many young girls. The Chicago Vice Commission,<sup>1</sup> in its recent report, strongly recommends rigorous supervision of all such resorts. An excellent movement is now being made in some States to teach public school-children the evils of alcohol.

The frequency with which gonorrhea is contracted by intoxicated individuals is well known. Möller<sup>2</sup> gives some interesting data on this subject. He questioned 661 patients concerning the source of their infection. At least 20 per cent. of the number gave information sufficiently clear to make investigation of the source possible; 67 per cent. could give no information, having been intoxicated at the time of infection.

Although infection by means other than sexual intercourse is rare in any form of venereal disease, and especially is this so of gonorrhea, nevertheless steps should be taken to see that public lavatories be so constructed and cared for that the likelihood of transmitting contagion would be reduced to the minimum. The fact should never be lost sight of that it is the young who are most likely to become infected. Thus, LePileur states that, of 718 women affected with venereal disease, 62.9 per cent. were between sixteen and twenty years of age at the time of infection. Storer<sup>3</sup> found, of 140 single women suffering from venereal disease who applied for dispensary treatment, only 14 were over thirty years of age, while 62 per cent. were between seventeen and twenty-two years old. Among married women, the average age was somewhat greater.

<sup>1</sup> Social Evil in Chicago, Report of the Vice Commission, 1911.

<sup>2</sup> Möller, M.: Zeitschr. f. Bekämpf. d. Geschlechtskrankh., Leipzig, vol. v, part 7.

<sup>3</sup> Storer: Amer. Jour. Pub. Hygiene, 1908, p. 52.



In 1910 the Committee on Education of the Public as to the Communicability and Prevention of Gonorrhea and Syphilis reported at the thirty-eighth annual meeting of The American Public Health Association, and presented the following suggestions: The Committee recommended: (1) The recognition, study, and control of the prevalence of these, as with other communicable diseases; (2) an educational campaign for parents and children, the teaching to be strictly medical (non-moral)—(a) Pamphlets; (b) utilization of State Health Department; (c) State Health Department to make effort to awaken interest in venereal disease among physicians; (d) State Health Department to send out paid and trained lecturers to address special meetings of parents, health officers, medical men, teachers, and others in schools, colleges, churches, etc., on these and other preventable diseases; (e) State Health Department to encourage the organization of associations for prophylaxis; (f) health departments to interest and provide for authorities having charge of educational curriculum in public and private schools—(1) By the introduction of biology into the graded courses of all schools; (2) to provide instruction in sexual matters for students of the upper grades; (3) by special instruction to students who are to become instructors. To impress upon presidents, deans, preceptors, and teachers the necessity of exercising their influence on students in reference to the communicability of gonorrhea and syphilis, and to inculcate a morale of protection among college fraternities; (g) to utilize the public press for the proper occasional presentation of the subject, and to discourage the display of advertising matter that encourages the exposure to these diseases; (h) to utilize church clubs, and especially mothers' clubs, for the instruction of parents; (i) health departments to recommend the enactment of laws for—(1) Physical inspection and segregation of prostitutes; (2) notification and report (by number, if desired) of venereal disease; (3) physical examination of men before marriage, male applicants for marriage licenses being required to submit to examination by a duly qualified physician for the purpose of ascertaining whether said applicants are free from venereal disease; (4) to make it a crime to spread venereal disease; (5) keeping open free night dispensaries and maintaining special dispensaries and hospitals for the treatment of these diseases; (6) advocacy of temperance on account of the relationship existing between alcoholism and venereal diseases; (k) advocacy of personal cleanliness and venereal prophylaxis; (l) advocacy of early marriage. These recommendations were adopted.

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26. Report of the Committee of Seven, Med. News, December 21, 1909.

## CHAPTER VI

### PROSTITUTION

THE history of prostitution can be traced back to the earliest traditions of the human race. Moses attempted to eradicate prostitution, but without success. Among the early Greeks and Romans prostitution was rife. As we follow the progress of time among the peoples of the world, so can the history of prostitution be followed from age to age. As surely as a community of any size is gathered together in a given locality, as surely will prostitution make its appearance. The number of prostitutes per thousand of the population varies with different races and at different times. It bears, however, always a direct relationship to the number of able-bodied unmarried men in any given community.

Although Flatau<sup>1</sup> and others have amply proved that continence is entirely compatible with health, it is, nevertheless, impossible to formulate laws that will eradicate or even control sexual desire—one of the strongest if not the strongest instinct of the human race. Often more powerful than the instinct of self-preservation, the sexual appetite may be provocative both of inestimable good and of much harm. Were it not for this passion, the world would quickly be depopulated; on the other hand, just as certainly, a very definite proportion of sorrow and crime can be laid at its door. As a result of many economic and social factors, "there has arisen in society a figure which is certainly the most mournful, and in some respects the most awful, upon which the eye of the moralist can dwell. That unhappy being whose very name it is a shame to speak; who counterfeits, with a cold heart, the transports of affection, and submits herself as the passive instrument of lust; who is scorned and insulted by the vilest of her sex, and doomed, for the most part, to disease and abject wretchedness and an early death, appears in every age as the perpetual symbol of the degradation and sinfulness of man. Herself the supreme type of vice, she is ultimately the most efficient guardian of virtue. But for her, the unchallenged purity of countless happy homes would be polluted, and not a few who, in the pride of their untempted ephastity, think of her with an indignant shudder, would have known the agony of

<sup>1</sup> Flatau, G.: *Sexuelle Neurasthenie*, Berlin.

remorse and despair. On that one degraded and ignorant form are concentrated the passions that might have filled the world with shame. She remains, while creeds and civilization rise and fall, the eternal 'priestess of humanity,' blasted for the sins of the people" (Lecky<sup>1</sup>).

The relation that prostitution bears to gonorrhea needs no confirmation. Huber,<sup>2</sup> in the routine examination of 533 sick and well prostitutes, found that 59.6 per cent. had gonorrhea. Prowe<sup>3</sup> detected gonorrhea in 76.9 per cent. of a series of prostitutes examined in San Salvador, Central America. While Dreier and Slachow<sup>4</sup> found positive proof of gonorrhea in 220 of 1021 inscribed prostitutes, and a suspicion of the disease in 94 additional women. Bendig<sup>5</sup> presents the following statistics showing the frequency of venereal diseases among prostitutes of certain cities of Germany:

CITY	POPULATION, LAST CENSUS	NUMBER OF PROSTITUTES UNDER CONTROL	FOUND DISEASED (VENEREAL DIS- EASES FOUND)	ARRESTED PROSTITUTES NOT UNDER CONTROL	FOUND DISEASED
Berlin.....	2,040,222	3,692	733	2,658	475
Hamburg.....	809,090	920	791	1,388	20 per cent.
Munich.....	538,393	175	36	Not given	207
Dresden.....	514,283	281	426	602	93
Cologne.....	428,503	1,116	672	About 700	232
Frankfurt a. M....	334,951	512	493	680	214
Hanover.....	250,632	210	182	378	80 per cent.
Stuttgart.....	249,286	22	28	500 to 700 annually	158
Chemnitz.....	244,405	76	80	300 to 350 annually	123
Charlottenburg...	239,512	122	16	524	8

There is every reason to believe that gonorrhea is extremely prevalent in the prostitutes of the United States, although, on account of our methods of dealing with this subject in this country, no accurate data are obtainable.

As Lawrence F. Flick has well said, in approaching the subject of prophylaxis of venereal disease, we should separate the moral from the sanitary side. It is sheer absurdity to assert that prostitution can ever be completely eradicated. The sexually frigid or superannuated may attempt to make laws aiming to govern the hot blood of youth,

<sup>1</sup> Lecky: History of European Morals.

<sup>2</sup> Huber: Wien. med. Wochenschr., 1898, p. 24.

<sup>3</sup> Prowe: Cent. f. Gyn., 1901, vol. xxv, p. 82.

<sup>4</sup> Dreier and Slachow: Die Prostitution, Bremen, in Hygienischer Beziehung, 1907.

<sup>5</sup> Bendig: Zeitschrift für die Bekämpfung der Geschlechtskrankheiten, vol. xxii, No. 1; also Bierhoff, F.: New York Med Jour., November 16, 1912, p. 1010.

but such laws can never be enforced. The question of prostitution is one governed largely by the great law of supply and demand. The high cost of living is undoubtedly an important factor to be considered in studying the question of prostitution at the present day. Too often the increased cost of living precludes or postpones marriage, and leaves in every city a large number of healthy individuals of both sexes whose normal and not infrequently excessive sexual desires have no legitimate outlet. There can be no argument regarding the existence of prostitution. It is estimated that in New York today there are between 50,000 and 75,000 prostitutes, and that \$125,000,000 is spent annually by the population of the civilized world for illicit sexual congress.

Kelly<sup>1</sup> estimates that venereal diseases cost America three billion dollars a year. These figures seem to be underestimated, rather than exaggerated. In the report of the recent Chicago Vice Commission it is estimated that the profits accruing from prostitution in that city alone amount to \$15,000,000 annually. The important question to decide is, What attitude shall be taken toward prostitution by those interested in the suppression of venereal disease? In deciding this question many important details must be considered. The Committee of Fifteen recommended—(a) That prostitution must be driven out of tenements and apartment houses and excluded from the houses of the poor; (b) that it must not be segregated, for such localities become areas of crime; (c) that all public manifestation of prostitution must be suppressed. There can be no question as to the expediency of the foregoing suggestions, with the one exception perhaps of the second. The belief that prostitution can ever be entirely abolished is Utopian. From time immemorial attempts have been made in many countries to eradicate it, but always without success, as witness the following instance: Many years ago, when Philadelphia was a factor in the shipping industry, the better class of citizens rose up against this evil, and brought their influence to bear on the police department, so that the closure of all, or nearly all, the houses of prostitution was effected. It was not long, however, before a petition was laid before the city fathers asking that the severity of the police control be relaxed, since it became unsafe for respectable women to walk the streets.<sup>2</sup> In 1607 Berlin closed all the brothels within the city, but was forced to reopen them. Similar failures followed efforts in France, in 1560, in England under the reign of Henry VIII, and later in Australia. In Pittsburgh, in 1891, an attempt was made to close all houses of prostitution, but

<sup>1</sup> Kelly, H. A.: Jour. Amer. Med. Assoc., October 6, 1912, p. 1312.

<sup>2</sup> The author questions the veracity of the latter statement.

this failed. A year later, in New York, a similar effort was made, with the result that vice was disseminated throughout the city. Nearly every city of any size in the United States has at times been swept by waves of moral virtue that have resulted in crusades against the so-called "social evil." How useless, and often actually detrimental, such efforts have always proved is a fact well known to students of sociology and those interested in the prophylaxis of venereal disease.

As has previously been stated, much diversity of opinion exists as to the best methods of handling the difficult problem of prostitution. In this connection, however, it is interesting to observe the unity of opinion that exists in the recent reports issued by the Police Commissioner of Boston, the Committee of Fourteen in New York, and the Mayor's Vice Commission of Chicago. These committees are agreed on the need of stern repression of overt vice; of a more wide-spread dissemination of medical knowledge among lay adults; of sound, thorough education of the young in the fundamentals of sex hygiene; of strict enforcement of individual responsibility; and of the paying of a "living wage" to girls employed in the industries. They also recommend the abolition of the rear door and hotel features in connection with the saloon. Of especial significance is the fact that the committees are unanimous in the belief that crusades, and the like, are harmful, particularly when conducted, as they often are, by misguided fanatics.

The question arises, Are the regulations suggested by these committees sufficient to govern the evil, or is the regulation or supervision of prostitution by municipal authorities advisable? Before determining so important a point, let us review briefly the methods in force in the various civilized countries to control this evil.

*Germany.*—Prostitution is recognized as a necessary evil, and municipal attempts are made to control it. The method employed varies somewhat in the different cities. In general, the principle is somewhat as follows: A special police department has been organized to control prostitution. These police officers are known as the "Sitzen-Polizei," and are divided into two groups—one to control the prostitutes, the other being the medical department. The work of the police department consists in a general supervision of the prostitutes. If a woman is seen soliciting in the streets she is questioned and cautioned. If, in spite of this warning, she is again found soliciting, she is brought to the police station, where she is again warned, and given a booklet containing information concerning institutions and organizations to which women may apply for assistance and medical

aid, and describing the dangers of illicit intercourse, venereal diseases, and their method of spread, etc. If she is under age, notice is sent to her parents. If, despite these warnings, she persists in her course of life, she is examined, and if found to be diseased, she is sent to a hospital, where she is detained until the period of her infectiousness is over. If she is found to be free of disease, she is inscribed, and given a book that is countersigned at each medical examination. No girl under eighteen years of age is inscribed, although if she is found to be infected she may be sent to a hospital for treatment. These police wear plain clothes and perform their duties unostentatiously. If arrest is necessary, a closed cab is employed. The police records are available only to the "Sitten-Polizei." This department occupies separate buildings having private entrances, exits, and waiting-rooms for the women. The entire proceedings are conducted with as little publicity as possible, and the women are well treated. The city of Berlin (2,500,000 population) is divided into twelve districts, each of which has a physician in charge. All first examinations are performed by a female physician, who receives 12,000 Marks per annum; the physicians in charge receive 24,000 Marks each. No woman can be inscribed who can show that she is earning money, however little, by means other than prostitution. The attitude of the "Sitten-Polizei" is governed, even to the minutest details, by printed rules. These rules make it easy for women to have their names removed from the inscribed lists and police regulation if they show evidences of wishing to reform.

In Dresden the medical examination is conducted in a most scientific manner. It consists of a thorough general examination, and the making of smears and cultures from scrapings from the cervix and urethra. The prostitutes are divided into three classes: Class 1 consists of all women under twenty-four years of age; of all women who have not been under control for one year, and of all other women who are thought likely to be a special source of infection. The women belonging to this class are examined twice a week. Class 2 consists of women between twenty-four and thirty-four years of age. These are examined once a week. Class 3 consists of women over thirty-four years old. These are examined every two weeks. Definite hygienic regulations are recommended to all prostitutes. In addition, there are certain special laws that they must observe. These forbid intercourse with minors. The prostitute is enjoined to dress decently, and to conduct herself with decorum when in public. She must not frequent certain parks and streets. She must not show herself at the windows of her dwelling, nor must she reside near schools or churches.



These are but a few of the many rules laid down to her. In Berlin, Dresden, and Leipzig brothels are not tolerated. In Hamburg this is not the case, and segregation is enforced. In the last-named city there is a sick fund to which all proscribed prostitutes subscribe. This fund is used to defray the expenses of the women that require medical treatment. There is in Germany a party known as the Abolitionists. These demand a medical certificate from each man about to marry, and regard it as an intolerable invasion of the personal liberty of women to demand that a prostitute, who may daily infect a dozen men, should be compelled to submit to systematic medical examination. In Dresden, since the regulations first described have been in force, gonorrhea has diminished 40 per cent. among the women examined (de Forest<sup>1</sup>).

Menge<sup>2</sup> states that gonorrhea is somewhat uncommon in the registered prostitutes, and that it is the clandestine or secret prostitutes who are the real disseminators of the disease. Excellent results have also been obtained in Hamburg. As the result of the regulations good order is maintained throughout the city, a state of affairs in striking contrast to the conditions that exist in the Prussian city of Altona, an immediate suburb of Hamburg, and separated from the latter only by an imaginary line. Of the venereal cases seen in the hospitals of Hamburg, 70 per cent. came from Altona (Bierhoff<sup>3</sup>). In this city no regulation is in force. Neisser and Blaschko<sup>4</sup> declare that regulation is of little value. In Berlin, from 10 per cent. to 25 per cent. of the prostitutes are under control, and this is probably the proportion in most of the large German cities.

Kelly<sup>5</sup> states that in Berlin there are 30,000 prostitutes, of whom 2016 are under control; in Vienna, 30,000, of whom 3063 are under control; and in Paris, 45,000, of whom 6000 are under control. Bierhoff<sup>6</sup> states that by the present system in 1911 there were 3024 sources of infection withdrawn from circulation in Berlin alone. Weidanz<sup>7</sup> states that venereal diseases have steadily decreased since the inauguration of the present system.

There is in Germany a National Association for the prevention of venereal disease, known as the Deutsche Gesellschaft zur Bekämpfung der Geschlechtskrankheiten (D. G. B. G.). This is an active

<sup>1</sup> de Forest: New York State Jour. Med., October, 1908, p. 516.

<sup>2</sup> Menge, K.: Handbuch der Geschlechtskrankheiten, Vienna, 1910.

<sup>3</sup> Bierhoff: New York Med. Jour., August 17, 1907; also *ibid.*, March 25 and April 1, 1911.

<sup>4</sup> Blaschko, A.: Syphilis und Prostitution vom Standpunkte der öffentlichen Gesundheitspflege, Berlin, 1893.

<sup>5</sup> Kelly, H. A.: Med. Press and Circ., August 14, 1912, p. 158.

<sup>6</sup> Bierhoff, F.: New York Med. Jour., September 21, 28, and October 5, 1912.

<sup>7</sup> Weidanz: Quoted by Bierhoff: *Loc. cit.*

organization, many eminent men and women being enrolled in its ranks. Thirty branch societies are scattered throughout Germany. The dues are 3 Marks. Each member receives monthly literature regarding the work accomplished by the Society. This organization has done much in the way of spreading education, increasing hospital accommodations for venereal patients, and making venereal disease an important branch of study in the various medical schools. The Society has distributed a large number of educational pamphlets.

For further information regarding the methods of dealing with prostitution in Germany the reader is referred to the exhaustive papers upon this subject by Bierhoff and de Forest.

*Norway.*—In this country much is being accomplished in the way of securing efficient prophylaxis. Venereal diseases are reportable; they are treated at public expense, and treatment is made compulsory. Physicians must inform their patients of the nature and contagious character of their disease. Patients are rendered liable for the expense of treatment of, as well as for damages suffered by, those whom they may infect. The person from whom the infection is derived is summoned to the sanitary office, and asked to submit to an examination. If they accept, and venereal disease is discovered, free treatment is furnished, if desired. If, however, the examination is refused, the individual must bring a certificate from a physician stating that he or she is either free from disease or is undergoing treatment. If a venereal disease is present, the patient must sign the following form: "Dr. ——— has told me that I am suffering from (name of disease), a contagious disease. He has fully explained to me the dangers of the disease with regard to myself and my associates and its probable duration, and has made clear to me that I must remain under treatment until he gives me a certificate to bring to this office that I am well and no longer a source of contagion. I know that if I have sexual intercourse during this time, whether I transmit the disease or not, I am liable to be punished, under Section XX of the laws of Norway." If, after signing such a form, the patient indulges in intercourse before he or she is pronounced free from contagion by the attending physician, the law is invoked. A monetary indemnity may legally be claimed by any man or woman who has knowingly been exposed to venereal disease, whether or not they have been infected. Those in charge of the sanitary offices are physicians.

*Sweden and Finland.*—These countries have adopted systems modeled somewhat after that of Norway. In Sweden segregation is in force. Christiania and Copenhagen have abandoned police regulation.

In Stockholm regulation is in force, but of the 3000 or 4000 prostitutes said to be in the city, not more than 500 are under control.

In 1903 the Swedish government appointed a committee to study and report on the question of prostitution. After seven years it declared itself against reglementation.<sup>1</sup> This committee stated that—"The objections which are brought to bear against regulation from a social, moral, and legal standpoint are so formidable that the usefulness which, from a sanitary point of view, it might possess, is not allowable as a consideration for its retention."

*Holland and Denmark* have abandoned police regulation. In the latter country compulsory notification by number of venereal diseases is in force. There are also numerous institutions in which free treatment may be obtained.

*England.*—In London, after a desultory attempt at police regulation, the effort was abandoned. At present no attempt is made at police regulation. The transmission of venereal disease by illicit intercourse is not an actionable offense, provided the congress has been voluntary, even though it can be shown that there was intentional and wilful concealment of the disease; nor is there any legal offense if the husband infects his wife or the wife her husband.

*France.*—In France prostitutes are under control. The system represents a combined effort on the part of the administration and the medical authorities to render the practice of prostitution less dangerous to the public health. A special corps of police is employed. Any woman in the streets suspected of prostitution may be arrested. If it can be proved that she is a prostitute, her name is inscribed in a special register, and she is given a card, which is countersigned at each medical examination. Inmates of brothels are examined weekly, and others are obliged to report for examination every two weeks. When found to be diseased, the prostitute is sent to a special hospital, St. Lazar, where she is detained until the infectious stage of her disease has passed. It has been estimated that there are over 100,000 prostitutes in Paris. The system has been in operation for over fifty years, and has been fairly efficient, as is proved by Fournier's statistics, which show that only 7.08 per cent. of infected men received their contamination from public prostitutes.

*Italy.*—This country provides numerous free beds for her venereal patients.

*Japan.*—In Japan prostitutes are strictly segregated. The persons who conduct the brothels employ physicians to make weekly physical examinations of the inmates. These examinations are thorough,

<sup>1</sup> Mitt. d. Deutsch. Gesellsch. z. Bekämpf. d. Geschlechtsk., April, 1911.

scientific, and modern. These persons also contribute toward the maintenance of the hospitals where contaminated prostitutes are confined and treated during the period of their infectiousness. The Japanese system is maintained not so much by law as by public sentiment.

*Austro-Hungary.*—In Budapest from 1700 to 2000 prostitutes are under control. These constitute about 40 per cent. to 50 per cent. of the total number. This control is exercised over prostitutes from all classes, differing radically in this respect from the German cities and from Paris, where the inscribed prostitutes are chiefly of the lower class. In Budapest registration is voluntary, but constitutes the only means by which a prostitute can avoid arrest and punishment. The control is associated with medical examination, which, however, is less thorough than in Germany.

According to Guiteras,<sup>1</sup> registration of prostitutes is in force in Havana.

*United States.*—In this country the method of dealing with the evil of prostitution varies quite markedly in different localities, owing to the State laws. In general, the feeling is strongly against any form of official recognition. Supervision has been attempted in a few cities, but has never met with the success hoped for by its advocates. In Detroit regulation was in force for one year and was then abandoned. At that time Detroit had a population of 400,000. It contained about 125 houses of ill fame, having 500 registered inmates. The great prevalence of venereal diseases in New York has recently forced the authorities to take some action to remedy the evil. As a result, the Page Bill, Paragraph 79, in 1910 became a law. This law provided for "the medical examination, by a woman physician of the Board of Health, of all females convicted of prostituting or soliciting, and the commitment of persons of this class who may be found affected with any venereal disease which is contagious, infectious, or communicable, to public hospitals, having a ward or wards for the treatment of the disease with which she is afflicted, for detention and treatment for a minimum period fixed by him in the commitment and for a maximum period for which she is committed to such an institution. She shall be discharged and released from custody upon the written order of the officer in charge of the institution to which she is committed, upon the certificate of a physician of such institution or of the department of health that the prisoner is free of any venereal disease which is contagious, infectious, or communicable. If, however, such prisoner shall be cured prior to the expiration of such minimum period for which she was committed, she shall be transferred to the

<sup>1</sup> Guiteras, R.: Amer. Jour. Pub. Health, March, 1912, p. 204.

workhouse and discharged at the expiration of such minimum period" (Bierhoff). No certificate of any kind is given to the woman. According to the Board of Police Magistrates, the law was effecting some good. After having been in force about a year, the Page law was declared unconstitutional. As a result, examinations were suspended in June, 1911. Schenck<sup>1</sup> states that regulation is in force in San Francisco and in Norfolk. He believes that the system has been satisfactory in the latter city. In Salt Lake City prostitution is ignored (1909), but the officials exact a license under the name of a bond. There are laws against prostitution, but these are not enforced. Segregation is practised to a certain extent. The *modus operandi* of the bond is as follows: Every month the prostitutes are arrested and are then bonded for \$10.00 or \$15.00 a head to appear and answer the charge of vagrancy. As they never appear, the bond is forfeited, and the money goes into the city treasury, and is equivalent to a license fee. A somewhat similar custom is—or at one time was—in force in New Orleans. In the majority of cities of the United States prostitution is not officially recognized and is considered an offense. Unless, however, it becomes too flagrant, no efforts are usually made to suppress the traffic. The fact that it is illegal opens an avenue for "graft" by petty police officers that practically amounts to a license system. Instead, however, of swelling the city treasury, the money remains in the hands of the police and ward politicians. Owing to the prevalence of venereal disease in the Philippines, it has been found necessary, in some localities, to issue a certificate of health to the women practising prostitution. The question as to the advisability of securing official recognition of prostitution in the United States is an extremely grave one, and a decision should not be reached before a careful consideration of all the facts bearing on the case is made. Much has been written on this subject, both in Europe and in this country. Many of those antagonistic to the official recognition of prostitution are influenced largely by the moral aspects of the question. The following is a condensed summary of the arguments that have been advanced for this official recognition:

#### ARGUMENTS FOR AND AGAINST THE OFFICIAL REGULATION OF PROSTITUTION

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| <p>1. Prostitution is immoral and should, therefore, not be licensed.</p>  | <p>1. This is undoubtedly a strong argument. Many authorities believe that regulation is the lesser of the two evils.</p>  |
| <p>2. Regulation does not regulate, and segregation does not segregate. Regulation has been in force for fifty years in Paris and venereal disease is still prevalent.</p> | <p>2. Efficient regulation is a matter of money and can be obtained by paying for it. Note the excellent results obtained in Germany. If regulation had not been</p> |

<sup>1</sup> Schenck, P. S.: Jour. Amer. Med. Assoc., November 23, 1912, p. 1916.

## ARGUMENTS FOR AND AGAINST THE OFFICIAL REGULATION OF PROSTITUTION—(Continued)

- Regulation has been abandoned in many countries. This would not be the case if it had given satisfactory results.
3. Regulation would tend to augment police "graft."
  4. One of the greatest protections against illicit intercourse is the fear of contracting venereal disease. By regulation and medical examination this would, to a great extent, be done away with, and, therefore, tend to increase immorality.
  5. Medical examination is inefficient. In many cases venereal disease can be diagnosed only by the specialist, and with the greatest difficulty.
  6. It is impossible to control all women practising prostitution; even in cities where regulation is most favorably carried out only a small proportion of the prostitutes are under control.
  7. At best, regulation affects only the women, while the men are quite as virulent spreaders of venereal disease.
  8. It is impracticable to house all the infected prostitutes in public institutions.
  9. Segregation produces centers of crime and depreciates the value of property.
  10. Segregation tends to increase the publicity of prostitution.
  11. Faults of administration often cause failure in the licensing system.
- believed to be of service, it would not have been maintained for fifty years in Paris.
3. As prostitution is now illegal, "graft" at present is prevalent. The city authorities recognize that prostitution is necessary, and therefore do not interfere, but allow the prostitute to pay the police of her district for protection.
  4. This argument cannot be entirely refuted. Certain extremists, however, claim that on this basis our attitude should be to favor the spread of venereal disease, so as in this way to make illicit intercourse more dangerous.
  5. With the aid of the Wassermann reaction and modern methods of cultures and staining of the gonococcus, diagnosis is not difficult—certainly not so in cases likely to produce infection.
  6. Regulation is not a means of eradicating venereal disease, but for every infected prostitute that is controlled, a certain number of cases of venereal disease are prevented. The lower class of prostitutes are the ones that always come under control, and are those in whom regulation is most necessary.
  7. Whereas a man has intercourse with one woman, a prostitute has intercourse with twenty or more men. But a small proportion of infected men will practise fornication, as they all know that they are infected. Some women are not aware of their condition, whereas others will continue their trade for financial reasons.
  8. The large number shows the urgency of reducing the amount of venereal disease. Only those in an infectious state need be incarcerated. It would seem that the new Ehrlich-Hatta specific may greatly diminish the time required to effect the cure of syphilis. Gonorrhea is a curable disease.
  9. Segregation tends to prevent the dissemination of vice, and therefore protects the innocent. Districts should be well lighted. Segregation is a natural result. Every large city has its "tenderloin," where property is not, as a rule, cheap.
  10. This is not the case, as witness Hamburg and other cities.
  11. Because a system is inefficiently administered, it does not follow that it is without value.



## ARGUMENTS FOR AND AGAINST THE OFFICIAL REGULATION OF PROSTITUTION—(Continued)

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| 12. Regulation would increase the number of prostitutes.  | 12. Not the case. But rather tends to lessen the dangers of seduction of innocent girls.   |
| 13. Medical examination of prostitutes is an outrage upon the sex and tends to degrade the woman. | 13. It is difficult to understand what injury a medical examination can do to the modesty of a class whose trade necessitates the abandonment of all modesty and the habitual exposure of the person for hire. Moreover, professional examinations for the detection of disease are common occurrences of every-day life, and are not held to be in the nature of an assault, even when made against the will of the individual, as in quarantine inspections or examination of soldiers held in our own and most other armies, for the purpose of detecting venereal and other diseases (J. R. Kean <sup>1</sup> ). |

The foregoing summary appears to favor official recognition of prostitutes. The crux of the situation is not whether such recognition could do good by lessening venereal diseases, but whether such a system could be efficiently enforced in the face of so many difficulties. It is the author's belief that, in this country at least, it could not be enforced for reasons that will be stated further on.

Harwood<sup>2</sup> tells of regulation in a settlement of steel workers the force of which was crippled by venereal disease. Medical examination and coöperation with the keepers of the brothels produced good results. Many similar instances are recorded in military posts and garrisons. It has been suggested that brothels be licensed by the municipal authorities, somewhat in the same manner that saloons are at present licensed in this country, the license to be a high one. It is claimed that this system would in some measure do away with many of the present objectionable features of prostitution. The police would know the location of each brothel, and could easily locate an inmate whenever desired. If desired, segregation could readily be enforced. Petty robberies and disorder would diminish or disappear, for a proprietor would not risk losing a license for which a large sum was paid annually—say \$1000—for insignificant gains. There would be fewer houses of ill repute, and those that did exist would be better kept. The present "graft" of the police would be done away with. The system would soon pay for itself. The "white slave" traffic and the harboring of minors would be lessened, if not entirely eliminated. The cancellation of the license, if the regulations were not obeyed, would always be a weapon to hold over the head of the proprietor.

<sup>1</sup> Kean, J. R.: Military Surgeon, March, 1912, p. 251.

<sup>2</sup> Harwood: Jour. Amer. Med. Assoc., December 22, 1906.



The fact that the houses were well managed would tend to drive the clandestine prostitute and dive-keeper out of business, and, lastly,—a very important point,—the sale of liquor in brothels could be suppressed entirely. The trade with minors—and there is no doubt that at present minors constitute a very definite proportion of the frequenters of certain houses of ill repute—would be eliminated. The system might easily be combined with medical supervision, but this would seem to be superfluous, since it would be to the proprietor's advantage to harbor only such inmates as are free from disease. A complete set of regulations would have to be drawn up, and it would be made compulsory for the keepers of such licensed brothels to observe them and see that they are enforced. It would be necessary to combine with the foregoing system a vigorous police crusade against all unlicensed brothels and street prostitutes. This plan requires the legalization of prostitution. Prostitution is now illegal, and therefore the police cannot be asked to supervise it. No law can be efficiently enforced unless it is satisfactory to the majority of the people. It seems almost certain that the American people would not tolerate the legalization of prostitution.

At the present day the inmates of many of the more luxurious brothels are examined at regular intervals by a physician employed by those in charge of the establishments. In Russia, in some of the houses of ill fame, a student physician is retained, who not only treats the inmates, but examines all the male patrons.

Excluding the moral aspect, theoretically regulation of prostitution should tend greatly to lessen the prevalence of venereal disease, and has been proved to do so in many of the smaller communities. With the possible exception of Germany, practical experience has thus far failed to demonstrate the advantages claimed for regulation. Powell<sup>1</sup> states that in St. Louis regulation did not lessen disease, but did increase licentiousness. Nevins<sup>2</sup> states that the system of regulation nominally established in India in 1888 was a failure.

The strife, as it at present exists, between the abolitionist and the regulationist, is a fruitless battle. The animosity, if not intolerance, that is often exhibited by the former, and that almost wrecked the Brussels Congress of 1906, is well known. Arguments as to the advisability of devising some means for lessening venereal disease may easily demonstrate conclusions upon the one side, but sentiment and conventionality are equally powerful in formulating contrary conclusions.

<sup>1</sup> Powell: Quoted by J. M. Mabbott, *Trans. New York Obst. Soc.*, 1909-1911, p. 388.

<sup>2</sup> Nevins: Quoted by J. M. Mabbott, *loc. cit.*

Great diversity of opinion exists as to the benefits to be derived from the attempted reformation of prostitutes. Certainly the attitude that is exhibited by the German government toward these women deserves praise. Even hardened prostitutes can scarcely be regarded as criminals, and there can be no two opinions as to the younger members of this profession. It is nevertheless a sad fact, admitted by most authorities on this subject, that attempts at rescue of prostitutes are not attended by marked success. There are in Greater New York 24 reformation and rescue homes. The work done by these institutions is most praiseworthy, but the percentage of permanent reformations that are effected is comparatively small. Unless the prostitutes are young or are reached early in their career, success rarely follows such efforts.

After an exhaustive study of the subject of prostitution and a careful review of the literature, the author is led to the following conclusions: (1) That efficient regulation of prostitution is possible, and would undoubtedly lessen the spread of venereal disease. Unfortunately, practical experience has shown that regulation in large cities is attended by so many almost insurmountable difficulties that its beneficent effects are almost nullified. Theoretically, regulation should be possible and efficient, but results do not sustain the theory. Excellent results have followed regulation in small communities, such as military posts, etc., but in large cities it is nearly impossible to enforce regulation with sufficient stringency to be of any service. (2) Owing to the high cost of living and low wages there is, in this country, an ever-increasing class of young women, drawn largely from the shop-girls and others who are forced to earn their own living, that are immoral. These girls are not prostitutes, in the ordinary sense of the word, and are not so considered by their associates. They are generally included in the class termed clandestine prostitutes, and are for the most part girls who are forced to add to their incomes in some way. The Chicago Vice Commission, in its recent report, has amply proved this point. Peterkin<sup>1</sup> states that in Seattle the clandestine outnumber public prostitutes 10 to 1. Kelly<sup>2</sup> believes that all vice is a reflex of social conditions—of poor housing and poor wages. He finds that in Baltimore 80 per cent. of the women employees in department stores receive less than a living wage. Regulation cannot reach this class. Nevertheless, while it is impossible ever to regulate all prostitutes, this should not detract from the good that can be accomplished by the control of some of them. (3) It would be unwise to

<sup>1</sup> Peterkin, G. S.: *Amer. Jour. Dermat.*, August, 1912, p. 407.

<sup>2</sup> Kelly, H. A.: *Jour. Amer. Med. Assoc.*, October 5, 1912, p. 1312.

attempt official regulation of prostitution in this country, owing chiefly to the strong public sentiment that exists against such a procedure. (4) At best, regulation of prostitution is of comparatively minor importance in the question of the prophylaxis of venereal disease, compared with educational and other methods, some of which will be described in the following chapter. These offer a far better prospect for the ultimate solution of this difficult problem.

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Chiefly American and English literature has purposely been referred to in the consideration of this subject.

## CHAPTER VII

### PROPHYLAXIS—METHOD OF DEALING WITH GONORRHEICS TO PREVENT THE SPREAD OF THE DISEASE

ONE of the most important points in securing efficient prophylaxis against venereal disease lies in effecting sterilization of the source of infection. The regulation of prostitution, even if properly enforced, controls only the female gonorrheic, the male being free to spread the disease, and although the woman is for many reasons the most prolific source of infection, the man is an undoubted factor, and must be taken into consideration if any satisfactory campaign against venereal disease is to be instituted. The necessity, therefore, of completely curing all venereal patients cannot be overestimated. A large proportion of venereal patients are unable to afford the services of a private physician, and the dispensary, and especially the hospital ward, accommodations open to such patients in this country are entirely inadequate. In New York city, in 1910, of 49 general hospitals, only 11 admitted venereal patients. Of 10,536 hospital beds, 400 were open to venereal patients, and these were not reserved for them exclusively, but were used for genito-urinary patients in general. Of these 49 hospitals, 36 were municipal institutions (Bierhoff<sup>1</sup>). In 1908, in Boston, only one hospital would receive a case of syphilis. In Philadelphia the Philadelphia General Hospital is the only institution that freely admits venereal patients. Christian<sup>2</sup> states that he sent a communication to 14 hospitals in Pennsylvania, all but one of which received State aid, requesting information as to whether or not they admitted venereal patients. A negative answer was received in every case.

In Cook County, Ill., there is only one hospital where venereal patients can receive free treatment, and there is only one other hospital in Chicago where pay venereal disease patients will be received.<sup>3</sup> A similar state of affairs exists all over our country. Increased hospital facilities for venereal patients constitute a crying need.

The Commission of the Medical Society of Pennsylvania<sup>4</sup> has re-

<sup>1</sup> Bierhoff: New York Med. Jour., August 17, 1907; also *ibid.*, March 25 and April 1, 1911.

<sup>2</sup> Christian, H. M.: The Pennsylvania Med. Jour., July, 1912, p. 790.

<sup>3</sup> The Social Evil in Chicago, 1911, p. 304.

<sup>4</sup> Report of the Med. Soc. of Pa., sixty-first annual meeting, September 25-28, 1911.

cently recommended that a medical certificate certifying that the applicant is free from venereal or other contagious diseases be demanded from every man who contemplates marriage; that one who conveys venereal disease should be punished by imprisonment, and that provision should be made for securing segregation, so that the public may be protected. These recommendations were accepted by the Society. The following resolution has recently been passed by the New York Obstetrical Society<sup>1</sup>: "That the time has come to make a beginning in the regulation and control of venereal diseases. That the first necessity is a place of detention and care for flagrant and especially dangerous cases." Fournier, Neisser, Brieux, and all authorities on this subject strongly recommend increased hospital facilities for venereal patients as a means of prophylaxis. Fournier suggests that not only should dispensaries be increased in number, and that each should have a number of small consulting-rooms, but that they should be open for two hours in the day and for a similar period in the evening. This last is an important suggestion, more especially for men, who in many cases cannot leave their work during the day for treatment.

Bernart<sup>2</sup> found that of a series of 50 male venereal patients, only 25 were able to leave their work for treatment during the day. The genito-urinary dispensary should be designated by a letter or number, so as to avoid the objectionable term, diseases of men. A female physician is of great assistance in a gynecologic dispensary, for a certain proportion of women prefer her to a male practitioner. The treatment in dispensaries for both men and women should be modern, and combined with facilities for making exact laboratory methods of diagnosis. Each patient should be warned of the nature and contagiousness of his or her disease. In the Teleia dispensaries in Budapest the patient, if married, is warned of the infectiousness of the disease, although care is taken not to incriminate the husband or wife, as the case may be. The possibility of extragenital infection is dwelt upon, and an effort is made to have the partner in marriage come to the dispensary for examination and treatment. Unmarried patients are told of the chronic and sometimes latent character of their disease, and are advised, in case of intended marriage, to return for a further examination. The Teleia dispensaries are successful along these lines, and the patients usually act on the suggestions made.

An excellent plan is that suggested by Rathburn,<sup>3</sup> who gives each venereal patient a small pamphlet. He finds that patients nearly

<sup>1</sup> Trans. New York Obst. Soc., 1909-1910.

<sup>2</sup> Bernart: Amer. Jour. Dermat., 1908, p. 270.

<sup>3</sup> Rathburn: Long Island Med. Jour., 1908, p. 24.

always take these home and read them. These pamphlets explain the nature and infectious character of their disease, its contagiousness, and dwell upon the necessity of continuing the treatment until a cure is effected. Such pamphlets can be printed at a very small cost. Rathburn has separate ones for the use of gonorrheies and syphilitics. Those intended for patients suffering from gonorrhea read as follows:

#### RATHBURN'S PAMPHLET

"Gonorrhea, or clap, as it is generally called by the laity, is a disease that is caused by a special germ or microorganism; whenever these germs are deposited upon a mucous membrane, as, for example, the genital organs, gonorrhea results. The disease is usually transmitted from one to another by means of sexual intercourse. It is possible to contract the infection through contamination from water-closets and other sources, if these have previously been infected by some one having the disease.

"It usually manifests itself in from three to ten days after exposure. The first symptom is a stinging pain on urination, followed by the discharge of pus from the urinary canal. Each drop of *this pus contains millions of bacteria and is highly contagious*. Its virulence may be estimated from the fact that a small drop, placed in the eye, would completely destroy this organ in one or two days.

"The disease, if properly treated, may be entirely cured in from four to six weeks. So-called 'cures' that claim to take effect in a shorter time are frauds. When neglected or *improperly treated, the disease becomes one of the most dreadful conditions that affect mankind, and one of the most difficult to cure*. It occasionally results in complete loss of *sexual power*, and sometimes, when neglected too long, becomes absolutely incurable.

"Men often believe themselves cured because there is no running or discharge, but a close examination on arising in the morning will often disclose the presence of a small drop, or if this is absent, the urine, when passed into a small glass, will show a cloudiness or a number of small shreds or particles (normally, urine, when passed, should be clear). These particles often contain large numbers of germs. *At this stage the disease is just as contagious as when an abundant discharge is present*. It is by this class of cases, occurring among men who think they are cured, but who in reality *are not*, that the disease is spread abroad, or the newly married man may infect his wife. The latter may have but little or no trouble at the time, but later on she becomes a chronic invalid, securing relief only as the result of a severe surgical operation, occasionally involving the removal of the entire uterus. Nearly one-third of

all the grave operations performed upon women in hospitals are done for diseases that had their origin in this cause. If children result from the marriage, there is a possibility of their being *blind from birth*. Practically all children blind from birth—and there are thousands of such cases—are rendered so as the result of gonorrhea in the parents.

“Now as to the method of avoiding the disease and its dire results. Without doubt the safest and best plan is to *avoid illicit intercourse*. *Sexual intercourse is by no means essential to the maintenance of perfect health*. Many of the healthiest and best developed men are those who have never had intercourse until they married.

“When, however, a man is so unfortunate as to acquire this disease, he should at once place himself under the care of a competent physician. If this is impossible because of lack of funds or from other causes, he should *apply to the nearest dispensary*, and remain under treatment not only until the discharge has ceased,—for the disease is not necessarily cured by that time,—but until the physician has pronounced him cured.”

#### SOME IMPORTANT POINTS TO OBSERVE IN THE TREATMENT OF GONORRHEA

1. *Don't attempt to treat yourself!* You would not attempt to treat yourself for consumption: it is no easier to treat gonorrhea.

2. *Don't be treated by your friend or druggist!* No two cases of gonorrhea are exactly alike, and what cured your friend may not cure you.

3. *Don't allow yourself to be treated by the quacks who advertise in the newspapers!* These are the worst kind of frauds and never cure the disease. They may arrest the discharge temporarily, but, not being properly cured, the disease returns in a few weeks or months.

4. *Don't neglect the condition until it becomes chronic!* It may take months or years of treatment to cure if you do.

5. *If you have had gonorrhea, don't marry until you have been examined by a physician and have been told that you are well.* The disease may lurk in the system long after you think you are cured.

6. *Don't fail to wash your hands thoroughly after each urination and after each time you touch the diseased parts.* Failure to do this may result in the loss of an eye.

7. *Don't have sexual intercourse until you are cured.* Not only will you infect your partner, but you will retard your cure.

8. Be careful not to infect water-closets or other objects from which disease may be conveyed to innocent persons.

The pamphlet just outlined is intended for the use of men, and a somewhat modified one should be prepared for the use of women, especially emphasizing the danger to children from sleeping in the same



bed with an infected mother. A pamphlet somewhat similar to this one was adopted in 1908 by the State Board of Health of Rhode Island and by the American Public Health Association, and is also employed at the new York hospital in Pennsylvania. In Iowa a movement has recently been instituted to place gonorrhea and syphilis upon the same footing with other contagious diseases.

At the present time Porto Rico and 34 States and territories have laws concerning ophthalmia neonatorum. Kerr<sup>1</sup> states that the State health authorities of Massachusetts, Rhode Island, New Jersey, and Vermont are specifically authorized in law to furnish prophylactic outfits to physicians for use in their practice. Kerr states that in France ophthalmia neonatorum is classed as one of the communicable diseases, must be reported, and is subject to disinfection. In Italy the regulation for midwives provides that the lids and conjunctivæ of infants must be washed after birth with a disinfecting solution, and that if inflammation develops, a physician must be called immediately. In Belgium a physician must be called to attend all cases of ophthalmia neonatorum, while midwives, before bathing the infant, are required to wash its eyes with sterilized water. In Bavaria the midwife is required to carry with her a vial containing silver nitrate solution, with directions for use. In Austria a penalty is provided for midwives failing to call a doctor in cases of ophthalmia neonatorum. Similar regulations are in force in Switzerland.

<sup>1</sup> Kerr, J. W.: Ophthalmia Neonatorum, Public Health Bulletin No. 49, October, 1911, Washington, Government Printing Office. Connecticut: General Statutes, 1902, Sec. 2535; District of Columbia: Regulation for the Prevention of Blindness, Sec. 1, 2, and 3; Idaho: Revised Codes, 1908, Sec. 1108; Illinois: Chap. 38, Hurd's Revised Statutes, 1909, Sec. 510 and 511; Indiana: Acts of 1911, Chap. 129, Sec. 1, 2, 3, 4, and 5; Iowa: Acts of 1896, Chap. 57, Sec. 1, 2, and 3 (omitted from code of 1897; Sec. 27, Chap. 20, Acts of 1897, declares that the code is "the authoritative publication of the existing laws of the State"); Kansas: Resolution, State Board of Health; Louisiana: Sanitary Code, 1911, 62 (a), (b), and (c); Maine: Revised Statutes, 1903, Chap. 18, Sec. 90; Maryland: Code of 1904, article 27, Sec. 231; Massachusetts: Revised Laws, 1902, Chap. 75, Sec. 49 and 50; also Chap. 458, Acts of 1910, Sec. 1 and 2; also Acts of 1911, Chap. 643; Michigan: Compiled Laws of 1897, Sec. 4475 and 4476; Minnesota: Regulation, State Board of Health, Sec. 80 and 81; Missouri: Revised Statutes, 1909, Sec. 8321, 8322, and 8323; Nebraska: Regulation, State Board of Health, Rule 29; New Hampshire: Acts of 1911, Chap. 121, Sec. 1, 2, and 3; New Jersey: General Statutes, 1895, p. 1676, Sec. 1, 2, 3, and 4; also Acts of 1911, Chap. 96, Sec. 1 and 2; New York: Consolidated Laws, 1909, Chap. 40, Sec. 482; also Acts of 1910, Chap. 513, Sec. 1; also Health Department; also State Department of Public Health Manual, p. 129; North Dakota: Acts of 1911, Chap. 188, Sec. 1, 2, 3, 4, and 5; Ohio: General Code, 1910, Sec. 12787; Oregon: Rules and Regulations, State Board of Health, 1911, Rules 1 and 3; Pennsylvania: Purden's Digest, thirteenth edition, p. 1886, Sec. 78, 79, 80, and 81; also Acts of 1911, p. 931, Sec. 10; Porto Rico: General Order No. 170, 1889; Sec. 51, 52, 53, 54, 55, 56, and 57 (given force of law by Sec. 8, p. 79; 31 Stats.L.); Rhode Island: General laws of 1909, Chap. 343, Sec. 25, 26, and 27; South Carolina: Criminal Code, 1902, Sec. 331; Tennessee: Chap. 10, Acts of 1911, Sec. 1; Texas: Acts of 1909, Chap. 30, Sec. 10; Utah: Acts of 1911, Chap. 61, Sec. 1; also Rules of State Board of Health; Vermont: Chap. 220, Acts of 1910, Sec. 1 and 2; Wisconsin: Annotated Statutes, 1898, Sec. 1409a (added by Chap. 59, Acts of 1909), 1409a, 1, 2, 3, and 4. Reference to decision rendered against individuals for infringements or lack of prophylactic measures against ophthalmia neonatorum may be found under *Cowley vs. People*, 83 N. Y. 464, and *People vs. Pierson*, 176 N. Y., 201.

Early in 1911 the London Council issued an order making ophthalmia neonatorum a reportable disease. Thus, as in cases of specific fevers, immediately on diagnosis a case must be reported to the health officer. The object is that more effectual means may be taken for its prevention and treatment. Several smaller towns have also adopted this measure. This is characteristic of the attitude taken by most English-speaking races toward venereal disease. If we recognize the infectious nature of ophthalmia neonatorum, how much more necessary is it that a similar recognition should be given to gonorrhea in adult patients who are up and about and, for many other reasons, are more likely to spread the disease.

The New York Board of Health now requires the registration of venereal disease in persons treated in public institutions, and requests all physicians to furnish similar information concerning private patients under their care, permitting the names and addresses, however, to be withheld. Such reports are considered confidential. The Department of Public Health also provides facilities for free bacteriologic and serum tests, for venereal diseases, when data required for the registration of the case are furnished.<sup>1</sup> California and Vermont require registration of gonorrhea, which is carried out by number and not by name. This is a step in the right direction. Individual rights should not be allowed to take precedence over public welfare.

Nearly all the increase in the efficiency of public hygiene has been attained by educational methods. No better way of directing the attention of the laity to the ravages of venereal disease could be adopted than by the formulation of a universal law requiring the registration of this class of maladies.

Professor Coplin, ex-director of Public Health of Philadelphia, is of the opinion that all male and female venereal patients that are likely to spread their infection should be forcibly controlled. In Massachusetts there is a statute (Chapter 75, Section 48) to the effect that an inmate of a public charitable or penal institution who has syphilis in a contagious form shall, at the expiration of his or her term, subject to the opinion of the physician in charge, be detained until such time as, in the physician's opinion, the said person is no longer contagious. There is no reference to gonorrhea. Like England, the United States has no law against infecting others with venereal disease, as shown by the recent decision of the Supreme Court of Mississippi.<sup>2</sup>

<sup>1</sup> Penn. Med. Jour., April, 1912, p. 581

<sup>2</sup> Austin vs. State (Miss.), 56 So. R. 345; also Jour. Amer. Med. Assoc., April 13, 1912, p. 1142.

An unusual case in point was that reported by Dr. Isadore Dyer, of New Orleans, before the Brussels Conference on the Prevention of Venereal Diseases in 1899—a patient with primary syphilis who refused even charitable treatment, and carried a book wherein she kept a record of the number of men she had inoculated. When she was first seen she declared that the number had reached 219, and that she would not be treated until she had revenge upon 500 men.

The system, as already described in the chapter on Prostitution, of making venereal disease reportable, as adopted by Norway, has been, in that country, extremely successful. In the large standing army of Germany there are frequent medical examinations, during which especial attention is directed toward venereal disease. If such disease is detected, the patient is sent to a hospital for treatment and detention. Too much stress cannot be placed upon the necessity of entirely curing gonorrhea, as the increase of the affection is due directly to the number of uncured cases. Physicians are sometimes to blame for allowing patients to discontinue treatment before they are entirely cured, and for not making thorough tests to ascertain this beyond question. It is, however, a fact that there are not a few general practitioners who, because of lack of knowledge or facilities, are unable to make such tests, and this is especially the case in dealing with female gonorrheics. It must always be remembered that chronic gonorrhea is the most potent factor in the spread of this disease. At this stage the symptoms are often mild, and the diagnosis in either the male or the female is difficult. The most painstaking effort should be made entirely to eradicate the disease. In some medical schools venereal diseases are not thoroughly taught, and, as a result, practitioners are sent out who are unable properly to treat such diseases, and who do not realize the importance of thorough treatment. State boards should emphasize the importance of venereal diseases. Patients suffering from venereal disease are notoriously difficult to control, and this is particularly true of dispensary patients. This doubtless accounts for many uncured cases. Davis<sup>1</sup> records that the number of visits to a clinic by 450 gonorrhea patients, nearly all of whom were in the acute stage, was as follows: One or two visits, 285, or 63.4 per cent.; three to five visits, 80, or 17.8 per cent.; six or more visits, 85, or 18.8 per cent. Even supposing that the majority of these patients went elsewhere for treatment, it is obvious that, in a large proportion, the course of the disease must have been prolonged. The quacks and patent medicine venders are also prolific sources of gleet, and should be suppressed for this, if for no other, reason.

<sup>1</sup> Davis, M. E.: Jour. Amer. Med. Assoc., November 9, 1912, p. 1689.

**Marriage of Gonorrheics.**—The frequency with which women are infected by husbands who believe themselves cured is well known. These women, it has been estimated, constitute one-third of all the married women suffering from gonorrhea seen in private practice. Occasionally the position is reversed, and the husband is the innocent sufferer, but this is by comparison rare. Morrow<sup>1</sup> estimates that there are 250,000 married women in the United States suffering from gonorrhea, a fact that evidences the necessity for securing prophylaxis in this direction. This is an extremely conservative estimate. The frequency of pelvic inflammatory disease and sterility among married women and their etiologic relationship to gonorrhea are well recognized. Physicians are in many cases to blame for not explaining more thoroughly, at the time of the acute attack, the nature, chronicity, and dangers of the disease in case of future marriage of their patients. Patients who do not continue treatment until cured are also to be censured. To safeguard the innocent, it has been suggested that each partner should be required to present a medical certificate stating that he or she is free from all contagious disease at the time the marriage certificate is issued. As the female is but comparatively rarely the source of infection at such times, and because of the obvious difficulties and unpleasantness attending an examination under such circumstances, it would seem that a certificate from the female should not be demanded. With the male, however, the condition is quite different. The proportion of men who have suffered from gonorrhea prior to marriage is very large, and the necessary examinations are much less embarrassing. If, as has been suggested, venereal diseases were made notifiable, this in itself would greatly facilitate such prophylaxis regarding those who had at any time suffered from gonorrhea. Here, too, a law making it a punishable offense to communicate a venereal disease would be of especial benefit. In 1905 the State of Indiana passed a law to the effect that no person afflicted with a transmissible disease shall be privileged to marry. The State Board of Health is given discretionary powers in the execution of this statute. They propound questions to every applicant for a marriage license. The answers must be sworn to, and penalties prescribed for concealment of venereal disease under such circumstances. Similar laws are in force in North Dakota, Michigan, and in some other of our western States, as well as in Holland and Spain. The Ohio State Medical Association, at its meeting in Cleveland on May 18, 1911, urged the passage of State Bill No. 31, which provides for the physical examination of all

<sup>1</sup> Morrow, P. A.: *Social Diseases and Marriage*, 1904.

men applying for a marriage license.<sup>1</sup> Similar legislative measures are now being considered in Utah.<sup>2</sup> Such laws, if made general, would to a certain extent be evaded, but their moral effect, by calling attention to the necessity of freedom from venereal disease in those about to marry, would be extremely beneficial.

**Ethical Duty of Physician Toward Gonorrheics.**—Professional secrecy is one of the oldest and most praiseworthy assets of the medical profession, and the necessity for it has been recognized since the time of Hippocrates. In the majority of our States, as also in most foreign countries, laws are in force definitely to cover this point. Article 834, of the Code of Civil Procedure of New York, reads as follows: "A person duly authorized to practice physic or surgery shall not be allowed to disclose any information acquired in attending a patient in a professional capacity, and which was necessary to enable him to act in that capacity." This law, however, is not enforced, for it does not carry with it a penal responsibility for its violation. The French law is more severe, and prescribes a punishment of from one to six months in prison and a fine of from 100 to 500 francs. In individual cases exceptions have been taken to such laws both in this country and abroad. Much has been written upon this subject, and there is no doubt that a physician should, under such conditions, be influenced largely by the circumstances surrounding the individual case. The cases that are usually the most difficult of solution are those in which a man, known to the physician to be the victim of an infectious gonorrhea, purposes to marry a healthy woman; in such cases tact, discretion, and firmness will in most instances suffice. In a case seen by Piogey the intended bridegroom insisted on the marriage taking place, declaring that the ceremony was absolutely necessary because of financial reasons. He was prevented from accomplishing his crime only by Piogey threatening public insult and a subsequent duel. Such chivalrous methods are, of course, hardly necessary in this country, and in more than one instance a jury has upheld a physician who has interfered under like conditions. The general trend of both the professional and the lay opinion seems, very rightly, to be toward a relaxation of strict professional secrecy under such circumstances.

**Personal Prophylaxis.**—This includes such measures as may be adopted by the individual, male or female, either before or after coitus, to prevent venereal infection. This subject, like that of prostitution, undoubtedly has a moral aspect, and the question whether we should recommend means by which infection may be more or less combated,

<sup>1</sup> New York Med. Record, May 27, 1911.

<sup>2</sup> Bogart, G. H.: Amer. Jour. Dermat., January, 1912, p. 23.

is not unassailable. Whatever harm might be wrought by the dissemination of such knowledge among the laity, there can be no two opinions as to the benefit to be derived from such treatment in our soldiers in the efficiency and defensive strength of our army and navy. Perhaps the simplest means of securing personal prophylaxis is by urinating and washing or douching the genitalia immediately after a suspicious intercourse. Urination and, at the same time, pinching together the lips of the meatus so as to insure thorough washing out of the anterior urethra, is a common practice among men. This simple procedure is often effective, and the failure to adopt it no doubt accounts, to a great extent, for the frequency with which intoxicated individuals, when exposed, contract gonorrhea. Möller<sup>1</sup> states that 67.7 per cent. of 661 venereal patients contracted their disease while intoxicated.

Gonococci develop most favorably on a medium that is nearly neutral. The urine is usually strongly acid, as is also the urethra, but as a result of sexual excitement considerable mucus that is alkaline in nature is thrown out, thus rendering the canal receptive to infection. Hence infection is favored by all conditions that stimulate the secretion of mucus. These include prolonged sexual excitation and local congestion, protracted and repeated intercourse, and all factors that retard the orgasm, such as intoxication, etc. Alcoholic excesses also favor infection in other ways; under such circumstances withdrawal is likely to be delayed, and, too, the urine is more irritating than normal. It is well known that irritation of the mucosa predisposes to infection. The semen is alkaline, and hence tends to produce a reaction in the urethra favorable for the growth of the gonococci. Probably the next most well-known prophylactic agent is the condom. This is an almost certain means of prevention of contamination from one partner to the other, provided the condom has not been previously infected and is not ruptured.

The history of the condom is somewhat in doubt. Pfister<sup>2</sup> states that he has found records that indicate the employment of a sort of penis sheath, or condom, by the ancient Egyptians, some two thousand years B. C. The invention of this article is, however, generally credited to John Cundum, an Englishman, some authorities claiming that he was a physician in the time of Cromwell; others describe him as a colonel in the Guards,<sup>3</sup> and as living during the reign of Charles II. However that may be, the condom attained almost immediate popularity, a

<sup>1</sup> Möller, M.: *Zeitschr. f. Bekämpf. d. Geschlechtskrankh.*, Leipzig, vol. v, part 7.

<sup>2</sup> Pfister, E.: *Zeit. f. Urologie*, Trans. German Urological Congress, Supplement No. 3, 1912.

<sup>3</sup> A Classical Dictionary of the Vulgar Tongue, 1785.



fact not to be wondered at when the prevalence of venereal diseases in England at this period is considered. As a result of the unpleasant notoriety which his invention achieved, the originator was compelled to change his name. The first of these articles was made from the cecum of a lamb, by stripping out the mucous coat and rubbing the skin with bran and almond oil until it became pliable.<sup>1</sup> The fame of these articles soon spread over the civilized world, and we find them the subject of the well-known witticism attributed to a lady of the French court.<sup>2</sup>

When the gonococcus is deposited on the mucous membrane of the genital tract, it has been found that some hours must elapse before the microörganism gains access to the underlying tissue. During this period the organisms may be washed off with comparative ease, and if it were not that they often entered the openings of small ducts or mucous glands, urination or simple washing would be even more effective than it is. The gonococcus is quite easily destroyed by antiseptics, especially the silver salts, and it is upon these two facts that the prophylactic treatment now so generally adopted in the navy is based.

Owing to the extreme prevalence of venereal diseases in the army and the navy, the medical officers of both departments have been forced to adopt measures tending to check the ravages of these diseases among the troops. Effective personal prophylaxis can be more thoroughly instituted in the navy than in the army. In the former the following scheme was attempted: When the men returned after leave of absence (shore leave), they were asked if they had been exposed to infection, and if they would care to take prophylactic treatment. This treatment was found to be so successful, and the proportion of men who developed venereal disease after such prophylaxis was so small that the system was finally, at least on most ships, made compulsory. On the U.S.S. *Ranger* the methods of carrying out the prophylactic measures are explained by the following rules:

1. All men, immediately upon return from shore, shall at once report to sick bay.
2. If they have been exposed to venereal infection, they will at once take treatment.
3. If they report themselves as not having been exposed to such infection, a record is kept, and should such a man subsequently develop venereal disease, he will be reported as having disobeyed orders.

<sup>1</sup> A matron named Phillips, at Half Moon Street, in the Strand, made a fortune from the manufacture of these little articles. She retired for a time, and having squandered her fortune, again took up their manufacture, which proved so successful that she was again enabled to retire in 1776.

<sup>2</sup> "A cuirass against pleasure and a cobweb against danger."



4. The sick bay will be open for treatment from 7 to 9.30 A. M. Men returning from liberty at unusual hours or whose duties prevent them from reporting at the time may receive treatment at any time.

The following instructions were posted in the sick bay:

1. Before coming to sick bay urinate and wash well with water.
2. In the sick bay wash well with the solution (bichlorid 1 : 2000).
3. Use half a syringeful of the injection, and retain it in the canal for three minutes. (The solution consists of 3 per cent. protargol and 15 per cent. glycerin. The glycerin causes the protargol to adhere to the mucous membrane. About 1 c.c. is injected, so as to reach the first inch of the urethra only.)

4. Rub the ointment (30 per cent. calomel) well into the whole penis, and leave it on for two hours.

The results of this treatment were as follows: Number of liberties, 39. Number of men on liberty, 949. Number of men exposed, 256. Number of men not exposed, 693. Result, no venereal disease.

This includes liberties in 10 different ports, many of which were well known to be rife with venereal disease.

A less elaborate but efficient form of chemical prophylaxis was recommended by Hausmann<sup>1</sup> in 1885. This author instilled a few drops of a 2 per cent. solution of silver nitrate into the urethra after coitus. This method was later indorsed by Ulmann,<sup>2</sup> Blokusewski,<sup>3</sup> Porosz,<sup>4</sup> Neisser,<sup>5</sup> and Frank.<sup>6</sup> The latter devised a portable dropper to be used for this purpose.

In 1899 Frank<sup>7</sup> performed an interesting experiment, tending to show the efficacy of the prophylactic treatment. The urethras of 6 men were inoculated with gonococci and 3 with 3 to 5 drops of a 20 per cent. protargol solution. These 3 escaped, while those not treated developed a specific urethritis.

The results obtained on the U.S.S. Ranger as regards prophylaxis against venereal diseases are merely confirmatory of those obtained on the U.S.S. Concord, on which ship, of 281 known exposures followed by the adoption of prophylactic measures, there resulted only two cases of venereal disease, both of which had exceeded their time allowance on shore, and, as a result, treatment had been delayed. The commanding officer of the Concord states that during the first five months in which these prophylactic measures were in force there was

<sup>1</sup> Hausmann: Deutsch. med. Woch., 1885, No. 25.

<sup>2</sup> Ulmann: Wien. med. Blätter, October 28, 1897.

<sup>3</sup> Blokusewski: Deutsch. med. Woch., 1895.

<sup>4</sup> Porosz: Monats. f. Urol., vol. ix, No. 2, p. 69.

<sup>5</sup> Neisser: Deutsch. Medicinal-Ztg., 1905, No. 69.

<sup>6</sup> Frank: Wien. med. Woch., 1901, No. 8.

<sup>7</sup> Frank: Allg. med. Cent.-Zeitung, 1899, No. 5.

not a single case of either gonorrhea or syphilis contracted by the crew. Henry<sup>1</sup> states that on the U.S.S. *Rainbow*, of 529 admitted exposures, there were four cases of gonorrhea; one of these failed to receive treatment, and two others were treated more than twelve hours after exposure; if these cases are excluded, there remains a percentage of 0.189. On board the *Charleston*, in the Philippines and in China, 3828 individual liberties were granted, of which number 437 failed to report, and of these, 32 developed venereal disease; 1396 admitted exposures were treated; of these, only one developed a disease. The *Culgo*, at Colombo, Ceylon, had 25 exposures, which were followed by prophylactic measures; no venereal disease resulted. On board the *Baltimore*, on the Asiatic station, visiting Sydney, Melbourne, and Auckland for one month each, with prophylaxis there was "practically no venereal disease," whereas the British ships, in the same environment, had over 25 per cent. of their crew infected. On the *Baltimore*, at Marseilles, the exposures were estimated at 2280; of these, 13 developed gonorrhea, only two of these receiving treatment. On this ship the list of men on liberty was sent to sick bay, and on their return they reported at sick bay and were checked off. If a man was under the influence of liquor, he was sent to sick bay in charge of a messenger. On the *Tacome* educational measures were attempted, but failed lamentably, and forced prophylaxis was instituted. Of 756 men exposed and treated by prophylactic measures, none developed venereal disease. On the *Virginian*, the following instructive results were obtained. For one quarter (three months) no prophylaxis was attempted and 30 cases of venereal disease developed. Optional prophylactic measures were instituted for two quarters (of three months each), and resulted in the development of 23 cases of venereal disease for the first quarter and 41 cases for the second quarter. During the last quarter compulsory prophylaxis was in force, and there were 13 cases of venereal disease. During the latter period 1178 men admitted exposure and were given treatment. Of these, 5 developed venereal disease. The remaining 8 had denied exposure and had not received treatment. Ledbetter<sup>2</sup> reports from Cavité, Philippine Islands, a station in which venereal diseases are prevalent, that prophylactic measures have reduced these diseases markedly. Previous to their introduction the percentage of venereal diseases of all classes among the men averaged from 25 per cent. to 30 per cent. annually, and at times even higher. The percentage of gonorrhea has been reduced to 8 per cent. annually, and this includes many patients who did not receive treatment. Rat-

<sup>1</sup> Henry, R. B.: Assoc. Military Surgeons U. S., Twentieth Annual Meeting, September 26-29, 1911.

<sup>2</sup> Ledbetter: Jour. Amer. Med. Assoc., April 15, 1911, p. 1098.

ing on a similar basis, chaneroids were reduced from 5 per cent. to 2 per cent., and syphilis from about 20 cases annually to one case in 1910.

At the naval station in New Orleans, the voluntary plan of prophylaxis proved ineffective, and compulsory methods were adopted. Of 500 men treated, no venereal diseases resulted. On the Salem, 5300 liberties were granted, and 6 cases of venereal disease resulted. Two of these delayed treatment and 3 did not receive treatment at all. On the Georgia, 7494 liberties were granted and 5500 treatments instituted; 33 cases of venereal disease resulted, and 10 of these followed delayed treatment. On the Rhode Island, on the trip home with the battleship fleet from Manila, all men returning from liberty were given prophylactic treatment, with excellent results.

Henry<sup>1</sup> has employed calomel, 50 grams, liquid petrolatum, 80 c.c., and lanolin, 70 grams, as a prophylactic on 529 men who admitted exposures; 0.189 per cent. developed infection through failure of the treatment. This writer further states that of a crew of nearly 200, there was not a single case of gonorrhea at the time of writing, a condition unknown prior to the introduction of prophylactic measures.

In the Atlantic fleet the voluntary system is still in operation on many ships. During June and July there were 5365 acknowledged exposures and treatments among a total of about 121,000 liberties. Of 429 cases of venereal disease, only 105 followed treatment, or a little less than 2 per cent. of known exposures. Combined reports from the Asiatic Station covering 1909, with 70,954 liberties and 21,166 admitted exposures, show 599 cases of venereal disease, of which 176, or 0.83 per cent., received prophylactic treatment. The prophylactic report of February, 1910, including the delayed January report from the Villalobos, showed 1714 admitted exposures among 9408 liberties. Among the entire crew there were 57 cases of venereal disease. The probable cause given is as follows:

	CASES	GONORRHEA	CHANCROID	SYPHILIS	PERCENTAGE BASED ON TOTAL CASES
Failed to report.....	15	13	2	0	26.30
Denied exposure.....	4	3	0	1	7.01
Overstaying liberty.....	1	1	0	0	1.76
Extended liberty.....	19	10	7	2	33.33
Treated early.....	10	4	5	1	17.54
Treated late.....	8	5	1	2	14.04

Failures of treatment, based on number reporting and treated on time: Number of cases, 10; percentage, 0.64; number of cases of gonorrhea, 4; percentage, 0.26.

<sup>1</sup> Henry, R. B.: Military Surgeon, May, 1912, p. 590.

The fleet surgeon states that many of these infections occurred in men in whom treatment was delayed. He adds that "There is no reason to think that a sense of security engendered by the scheme (prophylaxis) has caused any increased indulgence." Gates summarizes results as follows: Of 8516 known exposures, plus an unknown number of exposures from nearly 20,000 additional liberties, 57 cases developed after treatment, whereas 166 cases appeared among the untreated. Of the total number of cases of venereal disease, less than 20 per cent. developed among those who had received prophylactic treatment. The treatment on board ships varies but little, and consists of washing with soap and water and urinating before reporting at sick bay. In sick bay the following procedure is adopted: Wash in soap and water; then in bichlorid 1 : 1000 or 1 : 2000 for five minutes. Inject from 1 to 5 c.c. of protargol, 2 per cent. to 3 per cent.; or argyrol, 5 per cent. to 10 per cent., and retain the same in the urethra for from three to ten minutes by the clock. After drying, apply Metchnikoff's calomel ointment (33 per cent. to 50 per cent. calomel, made with lanolin or petroleum or mixtures of these).

Maus<sup>1</sup> recommends an ointment containing 30 per cent. calomel and 3 per cent. phenol in lanolin. This may be put up in collapsible tubes, which are convenient and cheap. The ointment is rubbed thoroughly over the entire penis and adjacent parts, and allowed to remain for two or more hours. In some cases, if the men are to go on duty at once, the ointment is covered with a light dressing. The men are instructed not to urinate for a couple of hours after receiving treatment. The author's experience has been confirmed by that of Ledbetter,<sup>2</sup> who prefers argyrol to protargol for the urethral injection, since the former is less irritating and more efficient. It may be employed as a 10 per cent. to 25 per cent. solution. The addition of a little glycerin is beneficial, as it causes the mixture to adhere to the urethral mucosa. In some cases 2 per cent. protargol solution, if retained in the urethra for five minutes, causes pain and discomfort for some hours after the treatment. The consensus of opinion among the medical officers of the navy is that if this treatment is thoroughly administered within eight hours of exposure, protection is almost certain; if within twenty-four hours, it is of great value, and should be employed even up to forty-eight hours; later than this, however, it is of little use. In the navy the treatment is given not by the surgeon, but by hospital attendants and enlisted men of the naval corps. This is due to the fact that returning liberty parties on large ships sometimes number 250

<sup>1</sup> Maus, L. M.: Quoted by J. M. Phalen, *The Post-Graduate*, April, 1912, p. 225.

<sup>2</sup> Ledbetter: *Jour. Amer. Med. Assoc.*, April 15, 1911, p. 1098.

men. Compulsory measures are not adopted universally in the navy, but are subject to the approval of the commanding officer. In addition to the medical prophylactic treatment, educational methods are in force on many ships, the men being instructed regarding the frequency and dangers of venereal disease during the first-aid instruction. In the German navy prophylactic packages are on sale at a nominal price. Failure to use the treatment is regarded as a military offense. The packages are small, and contain practically the same articles used in the United States navy. Prophylactic measures are also in force in the Japanese and French navies. Mummery<sup>1</sup> advocates their employment in the British navy, and believes that if such measures were adopted, venereal disease would be reduced 75 per cent.

In the army the conditions attending garrison life are not so favorable for the enforcement of personal venereal prophylaxis as in the navy, and this doubtless accounts for the fact that such measures have not been so widely adopted. Nevertheless, these have, to a certain extent, been attempted, and where introduced, have produced good results. Huff<sup>2</sup> recommends that a package be prepared whose contents are similar in general character to those used in the navy; that these be distributed gratuitously by the army medical corps, and that they be placed on sale at post exchanges. A similar, but less effective, prophylactic, known as the "K" package, is now in use at some posts. The "K" package contains a dram vial of a 20 per cent. protargol solution in glycerin, or a 10 per cent. aqueous solution of argyrol, and a medicine-dropper. Accompanying the kit is a pamphlet giving directions for use. Raymond<sup>3</sup> reports that of 576 men to whom "K" packages were issued, only three cases of gonorrhea resulted. All the infected men, however, used the solution improperly (*i. e.*, one or two days after exposure). This method of prophylaxis has been of great service in some stations in the Philippines, where venereal diseases are so rife. Wilson<sup>4</sup> reports that at Camp Stotsenburg, Philippine Islands, enforced prophylaxis has been adopted. Every man who is exposed is required to take the treatment. If he fails to do so, he is court-martialed and punished. The treatment is somewhat similar to that employed in the navy, and consists in urination, washing with soap and water, followed by the injection of a 10 per cent. solution of argyrol, which is held in the urethra for five minutes. As a last step, 30 per cent. calomel ointment is applied. Wilson believes that by this method 90 per cent. of venereal diseases may be prevented. He gives the following reasons for preferring this method to the distribution

<sup>1</sup> Mummery: Brit. Med. Jour., August 15, 1908, p. 394.

<sup>2</sup> Huff: Military Surgeon, 1909, p. 754.      <sup>3</sup> Raymond: Military Surgeon, 1909, p. 733.

<sup>4</sup> Wilson: Military Surgeon, February, 1911, p. 162.

of the prophylactic package: (1) The patient receives treatment under the supervision of a man who understands the method. (2) The patient is sober and treatment is thoroughly and properly administered. (3) Many men are not sober at the time of exposure, and either use the package treatment improperly or throw the package away without using it. (4) This method is more economic, as, with proper management, no waste should occur. (5) A full record can be kept, and as a result accurate statistics can be obtained. The disadvantage is that more time must elapse before treatment is applied. The army method is, for many reasons, less effective than the measures in force in the navy, and the "K" package further lacks the antisiphilitic and bactericidal properties possessed by the Metchnikoff ointment.

Feistmantel<sup>1</sup> relates an interesting prophylactic experiment: 640 soldiers were divided into three groups: one group received no instruction regarding prophylaxis, and approximately 5.8 per cent. were infected. Another group were simply instructed to urinate and wash the genitalia with soap and water after coitus; about 4 per cent. of these were infected. The third group were given regular prophylactic treatment, and about 2 per cent. were infected. None of the men who received prophylactic treatment within three hours of coitus were infected. Zieler<sup>2</sup> emphasized the importance of personal prophylaxis, and gives minute directions how the treatment should be carried out. He also urges that physicians should constantly inculcate the necessity for thorough daily cleansing of the external genitalia in both sexes, even in children. The multiplicity of secreting glands and the putrefaction of the secretions are likely to induce irritation and minute lesions which open portals to infection of all kinds. Guiard<sup>3</sup> recommends thorough washing out of the entire anterior urethra with a solution of potassium permanganate as a prophylactic against gonorrhea. Apart from the actual prophylactic properties of both the navy and the army methods, these are of value simply by calling attention to the prevalence of venereal disease. Phalen,<sup>4</sup> in referring to the situation in the army, states that the voluntary use of the "K" package has accomplished but little, and that the problem, as it now exists, is rather administrative than professional, and depends upon getting the exposed individual and the prophylactic remedy together.

Personal prophylactic measures are in force in the Japanese and French armies. The German forces, while abroad, are usually sub-

<sup>1</sup> Feistmantel: *Wien. med. Woch.*, 1905, Nos. 13 to 17.

<sup>2</sup> Zieler, K.: *Deut. med. Woch.*, Berlin, February 22, 1912, vol. xxxviii, No. 8, p. 345.

<sup>3</sup> Guiard, F. P.: *Jour. de méd. de Paris*, 1911, vol. xxiii, p. 175; also *Rev. prat. d. mal. d. org. gén.-urin.*, Paris, 1911-12, vol. viii, p. 46.

<sup>4</sup> Phalen, J. M.: *The Post-Graduate*, April, 1912, pp. 255-261.



jected to compulsory prophylactic treatment. Tandler<sup>1</sup> states that prophylactic measures—injections of 10 per cent. to 20 per cent. of protargol—were employed 1560 times in an army detachment of 170 men, and resulted in a 50 per cent. reduction of venereal disease. In the Austro-Hungarian army the experiment was made of issuing tablets of 5 per cent. formalin soap to men about to go on leave of absence. It has been suggested that small packages, with directions for use and containing such articles as are in vogue in the navy, be placed on sale at drug-stores for general use. Moral arguments may be adduced against such a procedure, but are hardly to be considered as reprehensible as the present wide sale of condoms. These last are, of course, purchased with malice aforethought, whereas medical prophylaxis offers a means of preventing an infection in one who has perhaps not expected to yield to temptation. Moral arguments against the use of medical prophylaxis can be based only upon the supposition that venereal disease is the punishment for transgression—an obsolete and Puritanical view that is detrimental to any cause, and that, carried further, would intimate that no attempts should be made to cure venereal patients. If the prophylactic properties of such packages were generally known, their sale would go far toward reducing the prevalence of venereal disease among men, and, therefore, among women. It seems to have been well proved that this type of prophylaxis can be used with great advantage by men. It is most efficient against gonorrhea and syphilis. On account of the short incubation period of chaneroid, this form of prophylaxis is less satisfactory when dealing with this disease. For anatomic reasons, a prophylaxis such as the foregoing is of less service in the female. Nevertheless, a somewhat modified form could be applied in many cases, and might, with advantage, be combined with other hygienic methods, such as douching, etc., now advised for prostitutes in those countries where regulation is in force.

In attempting prophylaxis of a disease as prevalent as gonorrhea, and one hedged about with so many difficulties, moral, civic, and personal, no one system can be effectual. The two important points to be desired are the protection of the uninfected and the cure of the diseased. We should not be hampered by moral doubts and platitudes, but should endeavor to utilize every known source to check this dreaded lesion. It is only by putting forth our strongest efforts that any hope of ultimate success can be harbored. We should realize that there is no one ideal prophylactic against gonorrhea, and that different methods are required to reach different people. Fear is undoubtedly

<sup>1</sup> Tandler: *Der Militärarzt*, November 15, 1905.



one of the most efficient. Educational methods will not control the criminal class, among whom venereal disease is frequent. It is true that educational measures may protect the next generation, but they will not prevent those now infected from disseminating their disease. No methods should be branded as inefficient unless they have been definitely proved to be so. Too much should not be expected in a short time, as, owing to the character of venereal disease, and of gonorrhea in particular, little can be hoped for except by a prolonged effort. Germany has, during the last few years, awakened to the necessity of action in this direction, and the scientific world can study with advantage the results of her numerous and efficient systems. It is impossible, however, to compare Germany with the United States. The character of the people, their surroundings, their educational methods, and the moral teachings there inculcated are all radically different from those existing in this country. Prophylaxis is, at best, largely a matter of money, and the necessary means of raising funds to carry on such a campaign lies largely with the charitable institutions, with individuals, and with the municipal authorities.

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## CHAPTER VIII

### THE EXAMINATION OF PATIENTS

THE examination of patients for the purpose of detecting the presence of gonorrhea may be divided into four distinct stages: History taking; inspection of the suspected region; palpation; and bacteriologic examination.

**Anamnesis.**—The case history should include the age of the patient; general previous history; menstrual history; marital history, which should include data regarding pregnancies, miscarriages, abortions, or sterility (relative or absolute); the existence of leukorrhea, and any subjective symptoms from which the patient may be suffering. Especial attention should be directed to the menstrual history, inquiries being made concerning changes in the character of the flow and the presence of dysmenorrhea. The question of conception is also an important one in this connection. Gonorrhea frequently results in sterility; occasionally, however, one or more children will be born, but an attack of sepsis followed by sterility is very suggestive of a Neisserian infection. Careful inquiry should be made regarding the occurrence of ophthalmia in the children, as its presence is an almost certain indication of gonorrhea in the mother. Leukorrhea is also an important symptom. An increase in the amount, and particularly a change from the ordinary whitish discharge to a thick yellowish or purulent flow, is a manifestation not to be overlooked, especially if this change in the character of the flow has followed marriage or a suspicious intercourse. Inquiries should also be instituted concerning the existence of vesical irritability, frequency of urination, dysuria, and cloudiness of the urine. The possibility of previous attacks of pelvic peritonitis, as well as of dyspareunia, painful defecation, etc., should be inquired into. In eliciting information much tact is necessary, and especial care should be taken to avoid wounding the patient's sensibilities. If the patient is a married woman, the questions should be so framed as to be entirely free from all suggestion of marital contamination.

**Preparation of the Patient for a Gynecologic Examination.**—In making an office examination, the physician should safeguard himself by having a reliable third person present. If he employs an office nurse, her presence is sufficient; if not, the patient should be directed

to bring an elderly woman, preferably her mother or an older sister, with her. The day before the examination the bowels should be thoroughly moved by a cathartic. In general gynecologic work it is usually customary to instruct the patient to urinate just before coming for examination. When gonorrhea is suspected the patient should be instructed not to urinate for four or five hours previous to the examination, so that if a purulent discharge is present in the urethra, its presence may be noted and an abundant amount obtainable for the bacteriologic examination. After cultures or smears have been taken, the bladder may be emptied. For similar reasons the patient should not take a vaginal douche before being examined.

**Examination Table.**—This should be so arranged as to secure a good light. This is a very important point. Although daylight is preferable to artificial light, the latter is so much more certain as to be almost a necessity. Care should be observed to select a powerful light, but one that can be so arranged as not to shine in the eyes of the physician during the course of the examination. A toilet and special examining room is of great advantage, insuring privacy for the patient both before and after the examination. If this is not available, the examining table should be completely screened off from the rest of the room. The patient should be directed to loosen all clothing about the waist and to remove the corsets. This is necessary not only for the abdominal examination which usually precedes the pelvic examination, at least in all new cases, but is essential for the making of a satisfactory pelvic investigation.

The variety of examining-table to be used is largely a matter of preference. A table that is moderately high, that inclines slightly away from the examiner, and that permits the patient to get on and off without difficulty is most to be desired. The top should be well padded, but not soft. One or two firm pillows are almost a necessity. One of these, placed under the patient's head, not only adds greatly to her comfort, but tends to relax the abdominal muscles. A pillow may also be used to elevate the pelvis when the patient is in either the dorsal or Sims' position. The examining-table should contain a drawer for holding instruments, or a special small table may be utilized to hold them, as well as the various medications and tampons, etc., that are likely to be required. Great care should be exercised throughout the entire examination to avoid unnecessary exposure of the patient. For this purpose one or two sheets are usually employed. These should be so draped as to permit the examiner to make a thorough inspection, with as little exposure of the patient as possible. Indeed, if this part of the examination is cleverly performed, the patient rarely

knows that she has been exposed at all. It is absolutely essential, however, that a thorough inspection be obtained.

**Instruments and Lubricants Required in Making a Gynecologic Examination.**—For the ordinary pelvic examination the instruments necessary are two trivalve or bivalve specula of different sizes, a Sims' speculum, a double tenaculum forceps, a pair of long, stout dressing forceps, and four applicators. The last are used for securing specimens for bacteriologic examination, a fresh instrument being used in each location. This is done to obviate the danger of carrying infection from one area to another. If the operator has a small alcohol lamp at hand, one applicator will be sufficient, its point being sterilized in the flame each time it is employed. Small slivers of sterilized wood (tooth-picks, for example) may be substituted for the metal applicators. These may be held with a pair of applying forceps while in use, their ends being covered with sterile cotton. The wooden applicators should be used only once and then destroyed. When there is a sufficient amount of secretion, and in all cases of vaginitis in children, the best instrument for securing material for bacteriologic examination is a medicine-dropper, or a small glass syringe to the end of which a small soft-rubber nozzle, about an inch or two in length, has been attached.

Van Gieson<sup>1</sup> has compared the results obtained by the use of cotton swabs with those secured by using the medicine-dropper, and finds that, with the latter, a considerably larger proportion of positive results were obtained. This is due to the fact that with the swab method the solid particles of secretion are caught in the fibers of the cotton, with the result that the material placed upon the cover-glass consists largely of serum. The mechanical trauma incident to attempting to transfer the discharge on the swab to the slide is often sufficient to injure or destroy the leukocytes or epithelial cells, thus making the detection of the gonococci and their intracellular demonstration more difficult. The intracellular establishment is an essential feature in the recognition of the organism. Apart from this, removal of thick, tenacious material, such as is found in the cervix, from the swab to the slide, is usually difficult. The application of the swab is also usually painful, and in cases of vaginitis in children frequently harmful. On the other hand, a medicine-dropper with a small soft-rubber nozzle can be easily and painlessly introduced into the vagina. If the secretion is scanty and cultures are not to be taken, the medicine-dropper may be partially filled with bichlorid solution, 1:5000. This is introduced into the vagina of the child, and, by compressing and

<sup>1</sup> Van Gieson: Med. Record, June, 1910.

expanding the bulb a few times, an emulsion of the exudate is formed. Another advantage of this method is that by it the entire vaginal contents may be obtained. The bichlorid fixes the cellular elements, and when dried on the slide, they are of perfect form. If necessary, the collected fluid may be centrifuged. This method is also useful in securing material from cases of ophthalmia. Whenever possible, in obtaining material for bacteriologic examination from adults, the pipet should be substituted for the swab.

An excellent instrument for obtaining a specimen of the suspected secretion from women is a blunt-pointed, dull, narrow-bladed bistoury. The small sharp spoons now made also answer the purpose admirably. Dufaux<sup>1</sup> has devised a little instrument for this purpose; it is shaped like a finger, and answers the same purpose in forcing out the contents of the glands, whereas the back is hollowed out to catch the droplet of secretion expressed.

It is sometimes advisable to collect the secretion for examination in thin glass or capillary tubes, sealing the ends of the same over the flame. The exudate thus secured may be employed for making cultures or smear preparations. For cultures it is inferior to direct inoculation. To make the smears, clean glass microscopic slides are required. These are best kept in a 70 per cent. alcohol solution, which sterilizes and keeps them clean and from which they may be taken for use as required. When cultures are to be made, test-tubes containing the media and four platinum loops with which to obtain the suspected secretion are necessary. In the ordinary case, these instruments will suffice. When, however, it is found necessary to examine the bladder, cystoscopic instruments will be required. In a case of unruptured hymen a large or medium-sized cystoscope may be used through which to inspect or treat the cervix or vaginal walls. This is also of use in making examinations of the urethra in cases of ulcers, localized areas of inflammation, strictures, or chronic urethritis.

For rectal examination, a proctoscope will also be required. The type of instruments employed is largely a matter of individual choice with the operator. Electric batteries can now be obtained, from which lights may be introduced not only through the cystoscope and proctoscope, but also through the ordinary vaginal speculum. These lights are often of great assistance. The routine employment of rubber gloves is an advantage. Not only is the danger of infection to both patient and operator minimized by their use, but the surgeon's hands are spared the frequent hard scrubblings and long immersions

<sup>1</sup> Dufaux: *Deut. med. Woch.*, Berlin, 1912, vol. xxxviii, No. 5.

in antiseptic solutions, which have a tendency to roughen the skin and make its sterilization more difficult. Their use also tends to save much time. An operator soon becomes accustomed to wearing rubber gloves, and learns to palpate quite as accurately with them as with the bare hand. But one glove need be worn, the hand on the abdomen being left bare. Gloves are best put on dry after sprinkling powder inside them, care being taken, however, not to allow an excess of powder to be deposited in the tips of the index- and middle glove-fingers, as the latter will impair the tactile sense. All instruments and gloves should be sterilized before being used.

Excellent lubricants are now manufactured by most of the physicians' supply houses. These are stored in a convenient form in collapsible metal tubes. The chief requisites of a lubricant are that it be easy of application, non-irritating, water-soluble, non-greasy, non-corrosive to instruments, aseptic, and easily removable from the hands. Glycerin is a good lubricant, and is soluble in water. Vaseline and other greasy substances exhibited in cups or wide-mouthed bottles should be avoided, because of the danger of contaminating the cups and thus inoculating subsequent patients. This objection may be overcome by sterilizing a number of small wide-mouthed bottles of vaselin and using a separate bottle for each case. At best, vaselin is not a satisfactory lubricant.

**Position for Examination and Local Treatment.**—The position in which the patient is to be placed upon the table varies with the case. In this country the dorsal, or lithotomy, position is the most popular, whereas in England the Sims' left lateral position is very generally employed. It is in only rare instances that it will be found necessary to use the knee-chest or other postures. The dorsal position varies somewhat according to the table that is employed. The most satisfactory tables are those having stirrups in which to place the feet. These stirrups are on a level with, or slightly above, the table, and are arranged on a movable arm, so that the position of the foot-support may be placed either nearer to, or farther from, the table, to suit the comfort and convenience of the patient. If bimanual palpation is difficult, further relaxation may be obtained by flexing the thighs upon the abdomen. This is known as the gluteodorsal position, and may be attained either by having an assistant support the limbs or by placing the patient's feet in elevated supports, such as are usually employed for plastic operations. At the same time the patient's buttocks should be brought well down over the edge of the table. When the patient is to be placed on the table in the dorsal position, the clothing should be loosened about the waist. The nurse or operator

takes a position in front of the patient, placing a sheet so that it will extend from her chest to the floor. The patient should stand immediately in front of the examining table, and be instructed to raise her clothing to the waist, and then to sit on the edge of the table. Next she lies down on the table, and her feet are raised and placed in stirrups. The sheet should at all times entirely cover the patient. A pillow is then placed under the patient's head, and the sheet so arranged as to expose the genitalia. The examination should then be proceeded with in a routine, systematic manner.

**Method of Performing Routine Examination and of Obtaining Material for Bacteriologic Investigation.**—The external genitalia should first be inspected, giving special attention to any inflammations, reddened areas, ulcers, or papillomata that may be present. The amount and character of the discharge should be ascertained. The condition of the hymen should be determined, for although the integrity of this membrane is not an absolute proof of virginity, the fact that it is ruptured is strong presumptive evidence of unchastity in the unmarried.

The next point to be examined is the opening of Bartholin's glands. The vulvovaginal glands, as they are termed by Huguier, are the analogue of Cowper's glands in the male, and are situated in the lower and posterior portion of the labia majora. They are rounded structures, somewhat flattened anteroposteriorly, and vary in size, even in the same individual. Usually the glands are about the size of an almond, and in thin women they can often be felt as a distinct thickening; in stout patients, in those who have not reached puberty, and in old age, palpation of these structures is usually impossible. When, however, an infection is present, the glands can easily be outlined from the surrounding parts by their hardness and induration.

Frequently, in bartholinitis, only the duct of the gland is involved. The orifice of the duct is situated about 0.5 cm. in front of the hymen, or carunculae myrtiformes, as the case may be, and at a point slightly below the junction of the middle and lower third of the labia minora, on the inner surface of these structures. The duct is about 1 or 2 cm. in length. Inflammation of any type, involving either the gland or its duct, causes a reddening about the opening. Inflammations of these regions are nearly always gonorrheal in origin. The typical maculae gonorrhoeae of Sanger consist of reddened, elevated areas about 3 to 5 mm. in diameter, firmer than the surrounding tissue, and somewhat resembling, in appearance, a mosquito-bite or flea-bite, the extreme center being dark red and elevated. Frequently, however, the only evidence of infection is a slight reddening or discolora-



tion about the orifice of the duct. In those cases in which gonorrhea is suspected the labia should be retracted, and the inner surface wiped dry with a piece of sterile cotton. Pressure should then be made directly over the gland, downward and outward, milking the gland and duct throughout their entire length. In the normal individual, if this has been properly performed, a small drop of clear mucus will be extruded from the gland opening. If this secretion is turbid or purulent, infection may be strongly suspected. A clear discharge is not, however, positive proof of the absence of gonorrhea. Smears should be made, or cultures taken from the secretion of both sides, and labeled B. R. and B. L., according to the side from which they have been obtained, or the operator may make a routine habit of examining various points in succession, and number the slides accordingly. Thus No. 1 would invariably indicate the secretion from Bartholin's gland on the right side; No. 2, from that on the left, and so on. The urethra should next be examined, particular attention being directed toward reddening of the external urinary meatus. The external orifice should be wiped dry with sterile cotton, and the urethra milked rather vigorously throughout its course. The secretion thus obtained may be used for making smears and cultures, these being labeled "U" or No. 3. In chronic cases the gonococci are most frequently found in Skene's ducts, which are situated in the floor of the urethra, just within the orifice. In the multipara the openings of these ducts are usually readily seen, but in women who have not borne children it sometimes becomes necessary to dilate the external urinary meatus slightly before a good exposure can be obtained. If infection is present, these structures can usually be discerned as small, reddened pits from which, when pressure is exerted beneath them, a small drop of pus often exudes. In order to secure secretion from them for bacteriologic examination a small probe may be used gently to scrape the floor of the urethra over Skene's ducts, and in suspicious cases it may be inserted a short distance into the glands themselves. A capillary tube, with a small bulb attached to one end to effect drainage of the exudate into the tube, is also an excellent instrument to use for this purpose. All such material may be set aside and labeled "S".

The next organ to be examined is the cervix. To do this the labia should be separated and wiped dry with sterile cotton, to avoid the danger of carrying infection from the external genitalia to deeper, perhaps uninfected, organs. If cultures are not to be taken, the external genitalia and inner sides of the labia are best sponged with a 1:1000 bichlorid solution. Antiseptics should not be employed if cultures are to be taken, for their use may inhibit bacterial growth.

The cervix is now exposed through a suitable speculum. The bivalve or trivalve speculum is usually employed for this purpose; it should be introduced with the edges parallel to the long axis of the body, and after it has been inserted an inch or two, rotated. When inserting any instrument into the vagina, it is important to make the necessary pressure backward toward the rectum, rather than forward or laterally. Before attempting to open the speculum it should be pushed in as far as is necessary, going somewhat downward and posterior to the supposed location of the cervix. A non-observance of this detail will permit the anterior vaginal wall to roll out in front of the cervix and obstruct the view of this structure. When possible, it is best to ascertain the position of the cervix by the touch before introducing the speculum. The cervix being exposed, its general appearance is observed, its size and the character of the discharge noted, as well as the presence of any areas of inflammation. Of especial significance in the nullipara is a reddened area immediately surrounding the external os. This is occasionally simulated by a congenital erosion of the cervix, but this condition is easily differentiated from a gonorrheal cervicitis. The cervix should next be swabbed with bits of sterile cotton, the thick, tenacious mucus that is present at the external os being removed as thoroughly as possible. A single smear or culture may now be taken from the secretion just within the external os. The cervical canal should now be dried further by means of small pledgets of sterile cotton. It is important that as much mucus as possible be removed from the canal. The cervix is now best fixed with a double tenaculum, and squeezed firmly either with the fingers or with forceps, or the lower portion of the canal may be slightly dilated, the material for bacteriologic examination being then removed from a point well within the cervical canal. Firm compression of the cervix is made in order to obtain the secretion from the cervical glands and from the deeper crypts of the canal, areas in which, in chronic cases, the gonococci are particularly likely to linger. The specimen thus obtained may be labeled "C" when it was taken from the cervix, or "C. C." when obtained from the cervical canal. If the patient to be examined is a virgin, the intravaginal manipulations can usually be performed through a large-sized cystoscope, without resulting injury to the hymen. In these cases it is sometimes best to administer an anesthetic. After having obtained a specimen for bacteriologic examination from the vulvovaginal glands, urethra, and cervix, the usual pelvic examination may be made, especial attention being directed toward detecting adhesions of the uterus or its appendages, and enlargements or lesions of the latter.

**Asepsis in Gynecologic Examination.**—In all forms of gynecologic

work strict asepsis must be maintained. This applies to examinations and treatments, as well as to operations. In making the routine examination laxity regarding asepsis will result not only in contamination of many previously uninfected cases, but will prove a bar to successful treatment. Where a number of cases are to be examined in succession, infection is particularly likely to occur unless thorough asepsis is carried out. Although the routine use of rubber gloves does much to lessen this likelihood, the observance of the usual precautions should not be neglected. Before each case is examined the hands should be washed and immersed in an antiseptic solution. All instruments and dressings should be sterilized. A good plan is to have two sets of examining instruments, one set being allowed to boil while the other set is in use.

**Sims' Left Lateral Position.**—Not infrequently, for purposes of inspection or for obtaining specimens for bacteriologic examination, the patient is placed in Sims' left lateral position. This posture has the advantage of being less tiresome for the patient than the dorsal position, but when palpation is to be performed, the former position is much inferior to the latter. In the Sims' position the patient lies on her left side, with the knees flexed nearly at a right angle with the thighs, the latter being similarly flexed on the abdomen; the right leg is more markedly flexed than the left, and the pelvis is tilted so that the right knee rests above the left and on the table. If the table is a narrow one, the left arm may be allowed to hang over the edge; if not, the arm should lie behind the back. The trunk should be so rotated as to bring the breasts in contact with the table. A firm pillow placed beneath the pelvis increases the inclination of the latter and is often of assistance. The examiner may now proceed in the usual manner, except that a Sims' speculum is substituted for the bivalve type. If the patient is placed properly in the left lateral position, the vagina will balloon out with air as soon as the speculum is introduced. An exception to this may be found in patients suffering from extensive pelvic adhesions.

**Knee-chest Position.**—In rare instances it may be found advisable to place the patient in the knee-chest posture. When this is done, the patient assumes the attitude of Eastern supplication, except that the face is turned to one side. The knees are brought to the edge of the table, the thighs being perpendicular. Success in both the knee-chest and the Sims' position depends on the proper tilting of the pelvis, which will permit the intestines to gravitate out of it; as a consequence, when the speculum is introduced, the vagina becomes filled with air. In both positions it is essential that the spine be relaxed

and the back bent forward. The knee-chest, or, as it is sometimes termed, the genupectoral position, is so trying for the patient that it is rarely employed in ordinary examinations. By its use, however, an excellent exposure of the entire vagina and cervix may be secured. For ordinary purposes the dorsal position is the preferable one, and if a table that permits the lower end to be elevated is employed, the intestines will gravitate out of the pelvis almost as well in this position as in either the Sims' or the knee-chest posture.

**Examination of Patients in Bed.**—Under some circumstances it may be necessary to examine patients in bed. In such cases the woman should be turned on her side, and the buttocks lifted well over the edge of the bed, the limbs being supported by assistants or allowed to rest on chairs. A pillow should be placed under the head. For purposes of palpation only the patient may lie on her back at the side of the bed, covered with a sheet and with her knees drawn up. The examiner sits on a chair beside the bed, to the left or right, according to the hand he is accustomed to employ in making vaginal examinations. Bed examinations are, as a rule, much less satisfactory than are those performed on an examining table.

**Methods of Palpation.**—In performing palpation of the pelvic organs, many methods are employed for securing relaxation of the patient's abdominal and pelvic muscles. On introducing the fingers into the vagina, pressure should be directed backward, and every effort made to avoid manipulation of the clitoris. The utmost gentleness is essential if a satisfactory palpation of the intraperitoneal generative organs is to be made. When a patient complains of pain or tenderness on one side, it is best to examine the opposite side first, for by palpating the diseased area at once, the patient will involuntarily contract her muscles, and thus render the remainder of the examination more difficult. One of the best procedures for securing relaxation of the abdominal muscles is to have the patient take deep breaths and keep the mouth open. It is essential to gain the confidence of the patient, for if she is frightened and fearful of being hurt, relaxation is rarely obtainable. For this reason the first steps in the examination, especially if it is the first examination, should be performed with the utmost gentleness, and if it is necessary to palpate tender structures, this should be done last.

Sonnenfeld<sup>1</sup> directs that the patient clasp her hands and pull vigorously. This will help to distract her attention from the examination, and thus facilitate the latter. It has been suggested that in cases in which there is marked rigidity over the lower abdomen, pressure be made slightly above the umbilicus by means of a broad leather

<sup>1</sup> Sonnenfeld: *Monats. f. Geb. u. Gyn.*, 1910, vol. xxxii, p. 572.

strap or sheet twisted into a rope for five or ten minutes, by which procedure, it is claimed, the recti muscles become tired and relaxation is obtained.

Structures can often be more easily palpated if the cervix is grasped with a double tenaculum forceps and drawn downward toward the vaginal outlet. By placing his foot on a stool or on the rung of a chair, resting the elbow of the examining hand on his knee, or by pressing his elbow against his side, the operator will be enabled to dispense with much of the muscular effort of the forearm that is usually required in making an examination, and that interferes with the fine sense of touch. Examinations should be conducted in a routine, systematic manner, each organ in turn, whether diseased or not, being palpated.

**The Use of Anesthesia in Gynecologic Examination.**—In cases that present any especial difficulties in the way of making a thorough examination or formulating a diagnosis, and whenever an adult patient is presumably a virgin, an anesthetic should be employed.

**Rectal Examination.**—Whenever it is deemed necessary to follow a vaginal examination by a rectal one, the danger of carrying infection from the genitalia to the bowel must be borne in mind. The perineum and anus should be carefully cleansed with an antiseptic solution, and clean gloves and instruments employed.

Rectal examinations are of especial value to the gynecologist in examining those patients in whom the hymen is intact. Not infrequently deeply placed structures can be more definitely outlined through the rectum than through the vagina. It is possible, by this method, to examine the posterior surface of the uterus.

**Bacteriologic Examination.**—The next step in the examination is the staining of the smear preparations. This can best be deferred until after the patient's departure. In all cases in which microorganisms resembling the gonococci are detected the Gram method of staining should be employed. In medicolegal cases, and especially in suspected cases in which the findings have repeatedly been negative, cultures should be made. In bacteriologically negative cases that present clinical symptoms of gonorrhea repeated examinations should be made in an effort to demonstrate the presence of gonococci. The methods of conducting such examinations, and the periods at which they are most likely to be successful, have previously been described in Chapter II. Unfortunately, the acute stage during which gonococci can usually be easily demonstrated in the discharge is also the time when a bacteriologic examination is least useful, as at this period a diagnosis may generally be made from the clinical symptoms alone,

whereas in the latter stage, when the disease has become chronic, it is often extremely difficult to demonstrate the presence of the specific organism. When clinical symptoms of gonorrhea exist and in the absence of the microorganisms in the secretions, as instanced by negative smear preparations, the case is best regarded as one of gonorrhea, at least until a number of bacteriologic examinations, conducted under favorable circumstances, have been performed. It is in such cases as these that cultures made by a skilled bacteriologist will be of especial service.

Boese and Schiller<sup>1</sup> consider that the recognition of the gonococci in smear preparations is not essential for the establishment of a diagnosis of gonorrhea, provided the clinical manifestations of the disease are present in the lower genital tract.

After the clinical symptoms of gonorrhea have subsided, all patients should be subjected to repeated—at least three—thorough bacteriologic examinations performed under circumstances favorable for the detection of the microorganisms before they are pronounced cured; if unmarried, they should be instructed to return for further examination when contemplating matrimony or on the first appearance of any symptoms suggestive of a recurrence of the original condition. In married patients the greatest care should be exercised to obtain complete cure before marital relations are resumed.

**Method of Dealing with Female Gonorrheics.**—It will here be sufficient merely to allude to what has been said in Chapter VII regarding the necessity of warning all gonorrheics concerning the nature of their disease and its dangers, both to themselves and to others. In this respect the physician's position is often an extremely difficult one, especially if the patient is a married woman. Under no circumstances should the patient be left in ignorance as to the infectious nature of her disease. On the other hand, care must be taken not to arouse suspicion of marital infidelity in a case that may possibly be the result of an extragenital infection. In this respect no rule can be laid down to govern all cases. Under such circumstances common sense and tact are the essentials. An endeavor should be made to have the husband consult a genito-urinary surgeon, as it is obviously futile to attempt to cure a gonorrhea in a woman whose husband is afflicted with a neglected or chronic gleet or other form of Neisserian infection, and who is constantly reinfecting his wife. There is no class of cases in which more tact, judgment, and diplomacy are required on the part of the physician than in the treatment of victims of marital infection.

<sup>1</sup> Boese and Schiller: Berlin. klin. Wochenschr., 1898, No. 26, p. 580; No. 27, p. 600; No. 28, p. 625; No. 29, p. 643; also Ann. de gynéc. et d'obst., Paris, 1898, vol. I, p. 226.



## CHAPTER IX

### GONORRHEA OF THE EXTERNAL GENITALIA

#### GONORRHEAL VULVITIS

THE most frequent etiologic factor in the production of inflammation of the vulva is the gonococcus. That gonorrheal vulvitis is not more often encountered among adults can be explained, to a great extent, by the histologic structure of this region. The covering of the outer portions of the vulva is similar to that of the skin, whereas on the inner surfaces of the labia the stratified squamous epithelium becomes more delicate and gradually merges into that of the vagina. It is only with difficulty that a lesion in the skin can be produced by the application of pure cultures of gonococci, and were it not for modifications resulting from local conditions, such as moisture, friction, and discharges, vulvitis in the adult would be even less frequent than it is. The comparative infrequency of vulvitis in adults as compared with children can be explained on the ground that in the former the protective epithelium is tougher, better developed, and therefore more resistant than in the latter. The bactericidal properties of the vaginal and cervical secretions with which the vulva is more or less constantly bathed also tend to lessen the dangers of infection in this location. This is particularly true of the inner aspects of the vulva, whereas the outer surfaces possess more definitely the histologic protective properties previously mentioned. Gonorrheal vulvitis in adults is nearly always secondary to gonorrhea in other portions of the genital tract, and usually results from the irritating discharge thus produced.

**Symptoms.**—In general these are similar to those symptoms accompanying dermatitis in other locations, but are somewhat modified as a result of local conditions. Bartholinitis, urethritis, and cervicitis are usually present. The severity of the symptoms varies according to the individual case. The onset is usually insidious, but may be abrupt. The vulva, and especially the fourchet, are red, swollen, and tender, and marked edema may be present. The resulting discharge may be thin and milky at first, but in a few days, if treatment is not instituted, it becomes profuse and purulent. Gonococci are present in the exudate. The tissues are intensely congested,



and in some cases the affected areas are partially covered with a pseudo-diphtheric membrane, beneath which ulcers may form. These ulcers are tender and bleed readily. The entire surface of the vulva is often bathed in pus, which also collects in the fossa navicularis. The carunculae myrtiliformes or, in the case of virgins, the hymen, is reddened, swollen, and tender. Occasionally infection of the hair-follicles or of the sebaceous or sweat-glands occurs, and when this takes place, numerous small pustules are present. In neglected cases, as a result of uncleanness, crusts may form about the external genitalia, and beneath these superficial ulcers and cracks or fissures may be present. In untreated cases the discharge usually gives rise to eczematous skin lesions on the surrounding parts. Condylomata acuminata and inguinal adenitis may accompany the condition. The latter is usually bilateral, although not infrequently one side is more severely or extensively involved than the other. The subjective symptoms necessarily vary with the gravity of the lesions present. In mild cases these may consist only of slight itching or chafing about the external genitalia, whereas in the presence of severe lesions the pain may be intense. As a result of the passage of urine over the inflamed areas, the symptoms are usually aggravated by micturition. Walking or friction also tends to increase the subjective symptoms, whereas rest in the recumbent position will allay the discomfort. When the condition is very acute and febrile, constitutional symptoms may appear, and these are especially likely to be manifested if an inguinal adenitis accompany the vulvitis. A neglected vulvitis of gonorrheal origin tends to run a chronic course and to spread to other portions of the genital tract. The diagnosis of gonorrheal vulvitis should always be confirmed by a bacteriologic demonstration of the specific organism in the exudate.

**Treatment.**—An examination should always be made to ascertain if the disease is secondary to a lesion in the upper genital tract; if this is the case, arrest of the irritating discharge is of the first importance. In making the examination to determine this point, care must be exercised to avoid introducing infectious material into the vagina from the external genitalia. (For the technic of examination see p. 188.) If the patient is found to be suffering from a cervicitis, a vaginal douche consisting of a gallon of bichlorid solution 1:5000 should be given twice daily, after which a suitable tampon should be introduced. This treatment is indicated not only for the cure of the primary lesion, but also to check the discharge, which in such cases is the exciting factor in the vulvitis. Cleanliness is an essential feature in the treatment of vulvitis. This is best effected

by shaving or cropping the hair of the external genitalia and by frequent douching of the inflamed areas with weak antiseptic solutions, such as bichlorid 1:8000, phenol 1:20 or 1:40, or 5 per cent. antipyrin. In the author's hands the last-named drug has given excellent results, not only because of its curative action, but especially for its antiprosic properties. Perrin<sup>1</sup> recommends irrigating the inflamed areas with a solution of sterile yeast, and reports that he has had excellent results from this treatment. The solution should be employed sufficiently often to keep the vulva free from discharge. This treatment is best applied by gently separating the labia and pouring the warmed solution over the affected parts. If this procedure does not entirely remove all the exudate, the vulva may be carefully wiped with pledgets of cotton soaked in one of the following solutions: 25 per cent. argyrol, 12 per cent. protargol, or a 3 to 6 per cent. silver nitrate. Webster<sup>2</sup> recommends a solution consisting of from 10 to 25 drops of formalin, 6 ounces of glycerin, and 14 ounces of water. The strength and choice of the solution should be governed by the severity of the attack. A strip of gauze or absorbent cotton moistened in the solution may then be placed between the labia, and a soft, sterile vaginal dressing applied. If the condition is a very acute one, and is accompanied by severe pain, the application of warm lead-water and laudanum may be employed continuously. Hot sitz-baths containing sodium bicarbonate are also valuable. During the acute stage patients should be confined to bed. After the discharge has begun to subside, itching may become a pronounced symptom. This can usually be relieved by the use of a 5 per cent. antipyrin spray or the application of a dusting-powder, such as boric acid and acetanilid, equal parts of each, bismuth subnitrate, or zinc oxid. Anspach<sup>3</sup> recommends the addition of 1 per cent. powdered burnt alum to the lead-water and laudanum. In the chronic stage, if small ulcers are present, their resolution may be hastened by the application of silver nitrate in the form of the solid stick. After each defecation or urination the external genitalia should be carefully cleansed with a weak antiseptic solution. Rectal examinations, the administration of enemata, and the introduction of suppositories are counterindicated in these and in all other cases of gonorrhea in which the possibility of introducing infectious material into the rectum exists. This precaution should be especially observed in those cases in which the discharge is profuse and is caused by an acute condition.

<sup>1</sup> Perrin: *Rev. Med. de la Suisse Rom.*, 1911, vol. xxxi, p. 732.

<sup>2</sup> Webster: *Diseases of Women*, Philadelphia and London, 1907.

<sup>3</sup> Anspach: *Gynecology and Abdominal Surgery*, Kelly and Noble, vol. i, 1907.

As in all cases of gonorrhea of the lower genital tract, all soiled dressings should be burned, the patient warned of the infectious character of the disease, and every prophylactic measure possible employed to prevent the spread of the infection. Especial care should be taken to avoid carrying the infection to the eye, thus preventing the development of ophthalmia. Coitus should be interdicted, and in chronic cases, where this cannot be prevented, precautionary measures should be adopted. When underclothing has been contaminated by gonococcus-bearing albuminous discharges, it is better first to place the garments in some disinfectant solution that does not coagulate albumin. If they are at once put in the steam sterilizer, the albumin in the discharge becomes coagulated and results in the production of unsightly stains.

#### CONDYLOMATA ACUMINATA

Condylomata acuminata, verruca acuminata, or venereal warts, are a frequent accompaniment of vulvitis, and are found most often among the uncleanly. They are particularly likely to appear if pregnancy should take place. These tumors occur more frequently and attain greater dimensions in women than in men, owing to the fact that in the former the gonorrheal discharges are constantly brought in contact with the vulva, perineum, and adjacent skin surfaces. The tumors may surround the anus, and on separating them, a fistula in ano is not infrequently found. Children are by no means immune, and infants and young girls suffering from vulvovaginitis are frequently attacked. Smith<sup>1</sup> has reported the occurrence of venereal warts of gonorrheal origin in an infant nineteen months old.

The vegetations vary in size from extremely small growths to tumors the size of a man's fist. They may occur as discrete excrescences, or they may coalesce, forming large, cauliflower-like neoplasms. The confluent tumors usually originate from a broad sessile base, whereas the discrete warts are not infrequently pedunculated. These outgrowths, except when they are modified by local conditions, are similar in color to the surrounding skin. Not infrequently, as a result of being continuously bathed in an irritating discharge, the warts become reddened or purplish in color and very vascular. Their surfaces may be macerated. They may be present on the vulva or contiguous skin surface, or, more rarely, may extend into the vagina. The symptoms arising from the presence of condylomata acuminata are similar to those of chronic vulvitis. The exudate is usually sanious, offensive, and highly irritating. The more vascular the warts and the thinner their epithelial covering, the more profuse is the discharge.

<sup>1</sup> Smith, R. R.: Amer. Gynecology, December, 1903.



FIG. 28.—CONDYLOMATA ACUMINATA OF THE EXTERNAL GENITALIA.

Showing a case of moderately extensive venereal warts. A number of discrete outgrowths may be seen about the anus and on the perineum, while on each side of the vulva oblong tumors, formed by the coalescence of numerous small growths, are present. The tumors on the skin show clearly the pointed character of these neoplasms. On the inner side of the right labium minus are two flattened, softened tumors, their condition being due to the location they occupy. In this case the vulvar outlet was bathed in a purulent discharge, and the mucosa at the external urinary meatus was reddened, thickened, and somewhat everted.



The diagnosis is, as a rule, not difficult. The possibility, however, of syphilis being the etiologic factor should always be considered before treatment is instituted. In general, gonorrheal vegetations may be distinguished from syphilitic condylomata by their smaller size and pointed appearance, the growths due to specific disease being, as a rule, flat and broad. In neglected cases too much weight should not be placed upon the appearance of the growth, but other symptoms and evidences of syphilis should be looked for. It should also be remembered in this connection that both diseases may coexist.

Condylomata acuminata probably are largely toxic in origin. The author has never been able to demonstrate the presence of gonococci in these tumors, although repeated efforts have been made. The organisms are frequently found upon the surface and in the crypts of the tumors. Similar results have been obtained by a number of other investigators. Streptococci and staphylococci have, however, been observed.

**Treatment.**—This consists in cleansing the affected area with weak antiseptic solutions, and checking the discharge, as described under the treatment of vulvitis. After the application of the antiseptic solution the warts should be dried with cotton, dusted with a non-irritating antiseptic powder, and a sterile dressing applied. This treatment should be repeated sufficiently often to keep the lesions dry. Motion should, so far as possible, be restricted. Although mild cases may respond to this treatment, as a rule more active measures are necessary. It is often difficult thoroughly to carry out this treatment in the class of patients among whom venereal warts are most prevalent. Even under the most favorable circumstances the palliative treatment is slow and tedious, and if the vegetations are of medium or large size, the method should be employed only as a preliminary to operative intervention. The type of operation selected will naturally vary with the size and shape of the tumors. If the warts are few in number, and especially if they are pedunculated, they may be snipped off with a pair of sharp scissors curved on the flat, and the base of the growths touched with fuming nitric acid. Before this is done, the surrounding skin surfaces should be protected with vaselin or other greasy substance. Care should be taken to remove as little healthy tissue as possible, for fear of opening avenues of infection. If only one or two tumors are to be excised, the operation can be performed under local anesthesia, a weak cocaine solution or Schleich's fluid being injected into the base of the warts, or they may simply be cut off without employing any anesthetic whatever. An excellent local anesthetic that has given good results in these cases is ethyl chlorid. Schein<sup>1</sup> has recently

<sup>1</sup> Schein: Wien. klin. Wochenschr., vol. xviii, No. 5.

reported the successful treatment of 30 cases of venereal warts by the use of ethyl chlorid alone; he freezes the base of the tumor and the tumor itself. This treatment effects obliteration of the blood-vessels by stasis and thrombosis, and in a few days the tumors dry up and drop off. If necessary, the treatment may be repeated at three-day intervals. The speed with which the cure is effected by the Schein method depends largely upon the type of tumor. The advantages of the ethyl chlorid treatment are that it is bloodless, requires no preliminary preparation, is nearly painless, and is applicable to all cases. In the author's experience, to be effective the freezing must be continued for four or five minutes for each tumor. This plan of treatment can often, with advantage, be combined with excision. In operations performed under local anesthesia, when the growths are numerous, it is best to divide the treatment into two or more sittings. In many cases in which the vegetations are extensive it is preferable to employ a general anesthetic and excise all the growths at one operation. If this method is decided upon, the patient should receive preliminary treatment for a few days or a week prior to the operation, with the view to sterilizing, as far as possible, the diseased area and arresting the discharge. Prior to the operation the parts may be painted with a 5 per cent. iodine solution. The pedunculated tumors are best removed with a cautery knife heated to a dull red. Those neoplasms that spring from a broad base can be most satisfactorily excised with the knife, every effort being made to avoid infection of the wound both during and after the operation. When the excision is completed, the wound may be closed by interrupted silkworm-gut sutures.

Watson<sup>1</sup> reports excellent results from the use of lactic acid in the treatment of these cases. Large masses are isolated and kept surrounded by strips of lint moistened in a 0.5 or 1 per cent. lactic acid solution, and the base of the tumors touched at intervals with the pure acid. Small growths are painted with a strong solution or with the pure acid. When the field is large, the minute vegetations are covered with a wet dressing. These dressings are frequently changed, and after each change a sitz-bath is administered. Watson states that small masses drop off, that the growth of large vegetations is inhibited, and that a cure results without leaving cicatrices and without accompanying pain. Occasionally, if the treatment is pushed too energetically, an erythema is produced. This is mild in nature and subsides rapidly on withdrawal of the acid. On this account, if large areas are involved, the healthy skin should be protected by

<sup>1</sup> Watson, D.: *Lancet*, London, April 13, 1912, p. 990.



vaselin and the acid entirely omitted for two days out of every week. The time required for cure by this treatment depends upon the individual case and the extent of the growth. One case was completely cured in twelve days, another in seventeen days, and an extensive growth disappeared in seven weeks. If the discharge is not checked and all the vegetations removed, the disease tends to recur. Prophylactic measures, such as are recommended in the treatment of vulvitis, should be instituted.

In severe cases the tumor masses may almost entirely cover the anus, perineum, and vulva. Under such circumstances the frequent wetting of the growth with urine and the contamination with fecal material add greatly to the discomfort of the patient and the difficulty of care. The most extensive growths are often seen in pregnant women, and the problem presented to the obstetrician under such circumstances is frequently a difficult one, as even with the greatest care and cleanliness the risk of infection at the subsequent labor is very considerable, especially if operative delivery becomes necessary. Naturally, the obstetrician must be guided by the individual case. Some authorities recommend excision of the tumors. This is the course adopted by Markoe<sup>1</sup> in the case of large condylomatous masses surrounding the vulva. Such operations frequently precipitate labor and should, therefore, not be undertaken until near term. Checking of the vaginal discharge and cleanliness are the sheet-anchors in the treatment of condylomata acuminata of gonorrheal origin, and, whenever possible, should always constitute the preliminary treatment to operation. The application of the x-ray seems to produce a marked inhibitory action on the growth of these tumors, and if persisted in, is said to produce a cure in many cases. Dubreuilh<sup>2</sup> has had excellent results with this form of treatment. The use of the x-ray is contraindicated during pregnancy because of the danger to the fetus.

#### BARTHOLINITIS

The glands of Bartholin derive their name from Bartholinus. These structures were studied by Huguier<sup>3</sup> in 1856, and were termed by him the vulvovaginal glands. The glands are situated in the lower and posterior portion of the labia majora, partly under the bulbocavernosus (sphincter vaginae) muscle. In some subjects they are entirely covered by this muscle, whereas in others they are partially embedded in the spongy tissue of the bulbs. The glands extend

<sup>1</sup> Markoe, J. W.: Bull. Lying-in Hospital, New York, June, 1912, vol. viii, No. 3, p. 113.

<sup>2</sup> Dubreuilh, W.: Jour. de Méd. de Bordeaux, August 11, 1912.

<sup>3</sup> Huguier: Mémoires de l'Académie de Médecine, Paris, 1856, vol. xv, p. 531.

posteriorly to the triangular ligament. Normally, they are about the size of a small bean, but vary quite markedly even in health, and as a result of inflammation they often become much enlarged. The ducts of the glands empty on the inner surface of the labia minora, just in front of the hymenal insertion. The glands are composed of numerous divisions. The infection, first of one branch and then of another, accounts for the recurrence of suppuration on the same side. The function of Bartholin's glands is to lubricate the introitus. The glands are the frequent lurking-place of the gonococci. The frequency with which the vulvovaginal gland is infected in cases of gonorrhea is equaled only in two other localities, namely, the urethra and the cervix. According to Luczny,<sup>1</sup> statistics collected from Olshausen's clinic show that this location is infected in 36 per cent. of all cases. Finger<sup>2</sup> found them infected in about 50 per cent. of his cases. Menge,<sup>3</sup> combining the statistics of Bumm, Steinschneider, Fabry, Brünsche, Bröse, and Welander, found Bartholin's glands infected in 20 per cent. of both chronic and acute cases.

The frequency of bartholinitis is dependent upon a number of factors—the location of the gland opening, which naturally makes it peculiarly likely to infection during coitus; the activity of the gland during sexual excitation; it seems fair to assume that during the process of lubrication of the introitus the opening of the duct of the gland widens somewhat; the location of the duct opening, which facilitates secondary infection by gonococci-bearing cervical or urethral discharges; and, lastly, the histologic structure of the gland and the chemical reaction of its secretion, which favor the growth of the gonococcus.

When vulvitis is present, the glands are nearly always infected, whereas, on the other hand, a bartholinitis is frequently present without an accompanying vulvitis. As has been stated, this is one of the localities in which gonococci are most prone to persist. In many cases a vulvitis and bartholinitis have both been present during the acute stage of the disease, but the infection of the vulva has either subsided or yielded to treatment, while that of the gland has continued, with the result that when the patient is examined during the chronic stage of the gonorrhea, the vulva appears normal, while the glandular involvement still continues and is more or less pronounced.

Bartholinitis has been observed as early as two weeks after the original infection, but may occur at any time during the course of a

<sup>1</sup> Luczny: Quoted by Clark: *New York Med. Jour.*, March 3, 1906.

<sup>2</sup> Finger: *Wien. klin. Wochenschr.*, 1897, No. 3.

<sup>3</sup> Menge, K.: *Handbuch der Geschlechtskrankheiten*, Vienna, 1910.

gonorrhea—most frequently during the first year of the disease. Bartholinitis may include varying degrees of infection of either the duct alone or of the duct and the gland.

#### CYST OF BARTHOLIN'S GLAND

If the infection is of a mild type and confined to the duct, occlusion of the latter may take place. The resulting cyst forms slowly, is ovoid in shape, and tends to bulge into the introitus. If pregnancy takes place, the growth of the cysts is usually more rapid. As the swelling increases the vaginal cleft becomes distorted. The surface of the tumor is smooth, and the gland exit is reddened and prominent. Only rarely will these tumors show transmitted light. The cysts vary in size from that of a pea to that of a goose-egg. Wiener<sup>1</sup> reports the history of an unusual case, in which the cysts were bilateral and measured respectively 11 by 8 cm. and 12 by 5 cm.

The cyst contents are viscid, colorless or yellow, or may be chocolate color, owing to an admixture of blood. They are usually unilocular and unilateral, and are said to be found more frequently on the left than on the right side. They may occur at any time after puberty, and in rare instances develop at an earlier age. The cysts are usually painless, but, owing to their size, they may cause inconvenience during walking or coitus. Bilateral cysts are more prone to produce discomfort on movement than are the unilateral tumors. Not infrequently the smaller cysts are discovered only accidentally, perhaps during the course of a gynecologic examination instituted for some other more important lesion. Indeed, in this way not infrequently small cysts are found the presence of which has not been known to the patient.

Because of extension of the infection or as the result of trauma the cysts may suppurate and an abscess result. These cysts are to be differentiated from hernia, hydrocele of the round ligament, vaginal cysts, solid tumors of the labium, perirectal abscess, and from hernia and cyst combined.

**Treatment.**—This consists of excision of the cyst, gland, and duct. For this purpose a vertical incision is made on the inner surface of the labia, over the tumor, and the entire cyst is dissected out. Care should be taken to avoid "buttonholing" the vaginal mucous membrane. In some cases the deep dissection may be facilitated by introducing a gloved finger into the rectum, pushing the tumor forward. But this procedure is to be avoided, if possible, owing to the increased danger of infection. If, during the course of the cystectomy, the

<sup>1</sup> Wiener, S.: *Amer. Jour. Obstet.*, February, 1912, p. 243.

cyst is ruptured, its removal will be facilitated by packing the cavity with a narrow strip of sterile gauze, as recommended by Schoenberg.<sup>1</sup> This distends the cyst cavity and facilitates the entire removal of the latter. It is better, however, when possible, to excise the tumor without rupturing it, as by this procedure excision of the entire cyst-wall is assured. Some authorities have suggested, as a preliminary step to the operation, the evacuation of the cyst contents and the filling of the cavity with paraffin, for the purpose of causing distention. As a rule, considerable bleeding from the depths of the wound occurs; this can be controlled by the introduction of a layer of buried fine catgut sutures. Care should be taken to leave no dead spaces. Drainage is not necessary, unless infection has occurred, and at the completion of the operation the skin may be closed by a subcuticular suture. The wound should be carefully guarded against infection. Palliative treatment, such as evacuation of the cyst contents through the duct and the introduction, through the latter, by means of a blunt-pointed hypodermic syringe, of formalin or a solution of silver nitrate, is unsatisfactory and usually results in recurrence of the cyst. In most cases simple incision is followed by similar results.

#### ABSCESS OF BARTHOLIN'S GLAND

Infection of the vulvovaginal gland by the gonococci may give rise to a non-suppurative adenitis. Indeed, Halle<sup>2</sup> and other writers assert that an abscess is always the result of a mixed infection. Cultures from the pus of these abscesses usually show the presence of the colon bacillus, *Staphylococcus albus*, or other pyogenic microorganisms, as well as the gonococcus. Infection of the duct or gland may be present without producing any palpable enlargement of either structure. The abscesses of the gland vary in size from one a few centimeters in diameter to one the size of a lemon, or in rare instances even larger. They are frequently pyriform in shape, the large end being directed toward the rectum. They occur as an accompaniment to a vulvitis, or may arise independently years afterward in patients who have never suffered from inflammation of the vulva. The abscess may be unilateral or bilateral, and tend to rupture spontaneously on the inner surface of the labia, just above the exit of the duct. In exceptional cases the pus may burrow through the capsule of Bartholin's gland and the abscess point on the perineum or even in the rectum. In this manner fistulas may develop. Owing to the histologic structure of the gland the abscesses are likely

<sup>1</sup> Schoenberg: *Surg., Gyn., and Obstet.*, 1910, vol. x, p. 309.

<sup>2</sup> Halle: "*La Bactériologie du Canal génital de la Femme*," Thèse de Paris, 1899.

to recur, as many as from twelve to fifteen manifesting themselves in a single individual in the course of a few years. The abscesses present the usual appearance of a suppurative adenitis. The local symptoms are often quite severe. The affected area is red, swollen, and edematous, and the patient complains of pain and tenderness, which are rendered worse by friction or walking, and are partially relieved by rest in the recumbent position, often with the thighs somewhat separated.

Mild constitutional symptoms are not infrequent. Inguinal adenitis may accompany the condition. In cases of old infection the glands may be palpable as hard, indurated bodies—the “adenitis glandulæ Bartholinæ scleroticæ” of Säger.

**Treatment.**—Before suppuration has taken place rest and the application of hot fomentations may, in some cases, abort the acute attack. If success does not quickly follow this treatment, or if pus is formed, the abscess and duct should be excised immediately, a similar technic being employed to that described for the treatment of a cyst of the vulvovaginal gland. Every effort should be made to avoid rupture of the abscess. If this occurs, however, the abscess cavity should be cauterized with fuming nitric acid, pure phenol, or tincture of iodine. A small gauze drain should be inserted into the lower angle of the wound, and the upper three-fourths of the incision closed with interrupted silkworm-gut sutures. In performing the operation it is of the utmost importance that all the glandular structure be removed in order to prevent a recurrence of the condition. If the abscess has already ruptured, the cavity should be packed tightly with gauze soaked in pure formalin before the operation is begun. Simple incision, cauterization, and drainage rarely effect a permanent cure. In chronic cases the diseased gland should be entirely removed by careful dissection.

#### URETHRITIS

The urethra is the portion of the genital tract most frequently primarily infected by the gonococcus. Welander<sup>1</sup> states that gonococci were recovered from this canal in 89 per cent. of his cases. Brünshke<sup>2</sup> places the frequency at 90 per cent.; Fabry,<sup>3</sup> at 52 per cent.; Steinschneider,<sup>4</sup> at 91 per cent.; Finger,<sup>5</sup> at 75 to 90 per

<sup>1</sup> Welander: Quoted by Clark: New York Med. Jour., March 3, 1906.

<sup>2</sup> Brünshke: Quoted by Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 81.

<sup>3</sup> Fabry: Deutsch. med. Wochenschr., 1888, p. 43.

<sup>4</sup> Steinschneider: Berlin. klin. Wochenschr., 1887, No. 17.

<sup>5</sup> Finger: Quoted by Stephenson, S.: *Loc. cit.*

cent.; whereas Luczny<sup>1</sup> records 85 per cent. Laser,<sup>2</sup> in 353 cases of gonorrheal infection, found the organism in the urethra 111 times. In 80 per cent. of these 111 cases there was no macroscopic evidence of a urethritis. Schultz<sup>3</sup> found gonococci in the urethra 78 times, and in the cervix, 81 times, in a series of 104 cases. Dannreuther<sup>4</sup> believes that the cervix is affected three times as often as the urethra. Pryor,<sup>5</sup> among 197 cases of gonorrhea in immoral women, found the urethra involved in 90 per cent. Menge,<sup>6</sup> combining the statistics of Bumm, Stein Schneider, Fabry, Brünsche, Bröse, and Welander, found the urethra involved in 95 per cent. of acute cases and in 30 per cent. of chronic cases. Menge's statistics agree closely with the author's findings. Hunner<sup>7</sup> is of the opinion that urethritis is usually secondary to a fresh gonorrheal inflammation of the vagina or cervix. There is no doubt but that, in the great majority of cases of gonorrhea of the female genital tract, the urethra is infected at some time during the course of the disease. Whether the infection occurs primarily in the urethra depends upon a number of factors. If the introitus is small or the male organ disproportionately large, or in the case of newly married women, primary infection in this region is likely; on the other hand, a gaping vaginal orifice will render the existence of a urethritis somewhat less probable. If, however, infection takes place primarily in the cervix, it is usually a matter of only a short time before the urethra becomes contaminated. Owing to the anatomic formation of the urethra, inflammation of this structure is, *per se*, much less severe than a corresponding infection in the male. The female urethra is about 3.5 cm. in length. The external urinary meatus has a diameter of about 7 mm. and, in the nullipara at least, is usually protected by two small, wing-like folds of mucous membrane, the labia urethræ; in the multipara, however, it is not uncommon to find the external urinary meatus somewhat enlarged and gaping widely. When the canal is at rest, the mucosa lies in longitudinal folds, between which, especially on its vaginal surface, there are numerous gland openings. These correspond to Littre's glands in the male. They vary from simple tubular structures to complex racemose glands. Toward the outer end of the urethra the glands are more numerous and complex.

<sup>1</sup> Luczny: Quoted by Clark: New York Med. Jour., March 3, 1906.

<sup>2</sup> Laser: Amer. Medicine, March 17, 1906.

<sup>3</sup> Schultz: Quoted by Pozzi, S.: A Treatise on Gynecology, Wm. Wood and Co., New York, 1897, p. 724.

<sup>4</sup> Dannreuther, W. T.: Med. Record, New York, November 4, 1911, p. 921.

<sup>5</sup> Pryor, W. R.: Amer. Jour. Obstet., 1896, vol. xxxiv, p. 384.

<sup>6</sup> Menge, K.: Handb. d. Geschlechtskr., Vienna, 1910.

<sup>7</sup> Hunner: Gynecology and Abdominal Surgery, Kelly and Noble, vol. i.

On the floor, just within the external urinary meatus, are two large gland openings. These were first mentioned by Skene,<sup>1</sup> and later more minutely described by Schüller,<sup>2</sup> who occasionally found a third and slightly smaller gland lying in the midline between Skene's glands. These glands extend upward along the urethra for a distance of from 5 to 16 mm., and end in a culdesac.

When the gonococcus is brought in contact with the mucous membrane of the urethra, it enters these structures and, extending through the cellular interstices, rapidly produces a very positive chemotaxis. As a result of infection the entire mucosa of the urethra becomes reddened, thickened, and congested. The mucous membrane at the external urinary meatus becomes everted and, when the labia are separated, presents as a reddened area. Skene's glands become inflamed; the openings appear as minute yellowish spots surrounded by an elevated, congested zone of inflammatory mucosa. The discharge is thin at first, but soon becomes thick and creamy. It is yellowish in color, and may even be blood-streaked, and at this stage contains large numbers of typical gonococci. Pressure over Skene's glands will usually result in the extrusion of a drop or two of pus from the gland exits.

Abscesses may form in Skene's or other of the urethral glands. As the majority of the glands of the urethra open in the floor of that structure, these areas of suppuration have been termed suburethral abscesses. Huguier<sup>3</sup> is generally quoted as having been the first to describe this form of gonorrhea, but Kelly<sup>4</sup> has directed attention to the fact that these lesions were previously described by Heys,<sup>5</sup> to whom credit for this observation is due. The abscesses are generally single, but may be multiple. Gicerin<sup>6</sup> has described a rare condition in which multiple follicular abscesses have occurred, first one and then another follicle being involved. Suburethral or para-urethral abscesses usually discharge their contents into the urethra, but may rupture into the vagina and produce urethro-vaginal fistulas. The abscesses are palpable as round or ovoid areas of induration or fluctuation, about 1 cm. in diameter, are extremely tender to the touch, and usually situated near the external meatus.

As the inflammation subsides and the condition becomes more chronic, the evidences of an acute lesion begin to disappear. The mucosa of the canal may regain its normal appearance, although it

<sup>1</sup> Skene, A. J. C.: *Amer. Jour. Obst.*, 1880.

<sup>2</sup> Schüller: *Festschrift f. Bernard Schultze*, Berlin, 1883, vol. iv, p. 16.

<sup>3</sup> Huguier: *Mém. de la Soc. de Chir. de Paris*, 1847.

<sup>4</sup> Kelly, H. A.: *Operative Gynecology*, 1907.

<sup>5</sup> Heys, W.: *Practical Observations in Surgery*, Philadelphia, 1805, p. 304.

<sup>6</sup> Gicerin: Quoted by E. Finger: *Die Blennorrhöe des Sexual-Organen und ihre Komplikationen*, Leipzig and Vienna, 1903, p. 300.



usually presents evidences of inflammation long after all subjective symptoms of the urethritis have disappeared. If, on inspection, the orifices of Skene's glands are found to be reddened and the surrounding mucosa is prominent, this is suggestive of a previously existing urethritis. The anterior third of the urethra is the location in which gonorrhea persists the longest. On making pressure over Skene's glands, even in old chronic cases, it is usual to obtain pus or a little murky fluid. The fact that no pus can be obtained from the urethra is no evidence that a complete cure has been effected. The gonococci frequently lie latent in the urethra, especially in Skene's or Schüller's glands, for prolonged periods, and may at any time set up an acute condition. Finger<sup>1</sup> states that gonococci not infrequently may be found in clear watery urethral secretions. For purposes of diagnosis Garceau's<sup>2</sup> modification of Skene's female urethroscope is of advantage.

An attack of urethritis is ushered in by a slight tickling, itching, or burning sensation in the urethra during and following micturition. In a day or two the symptoms become intensified, ardor urinae increases, and the desire to void urine becomes more marked. The urethritis may cause a vaginismus. If an abscess has formed in one of Skene's glands, the local pain and discomfort becomes much more severe. Gradually, as the lesions become less acute, the symptoms subside. Occasionally in chronic cases skenitis, as infection of Skene's glands is termed by Taussig,<sup>3</sup> produces symptoms which, if a careful examination is not made, may lead to an incorrect diagnosis of cystitis. The acute attack lasts, as a rule, from one to three weeks. During the chronic stage, which may continue for years, subjective symptoms are not infrequently entirely absent, and when present, consist of little more than a slight frequency and an occasional tingling or burning sensation during urination. At this time the urine is usually clear. Chronic gonorrhea of Skene's glands does not generally cause pain.

Spontaneous cure of urethritis undoubtedly frequently occurs; the apparent chronicity in some cases is probably due to reinfection by the discharge from the more intractable cervical lesions. Subjective symptoms vary widely in different cases, and even in acute attacks are often quite mild and transitory.

A point of importance in the diagnosis, and therefore in the treatment, of chronic cases is to determine the point of origin of the pus that may be obtained by pressure over the urethra; this usually comes

<sup>1</sup> Finger: *Wien. klin. Wochenschr.*, 1897, No. 3.

<sup>2</sup> Garceau: *Surg., Gyn., and Obstet.*, January, 1912, p. 80.

<sup>3</sup> Taussig, F. J.: *Jour. Mo. State Med. Assoc.*, November, 1912, p. 137.

## PLATE II



### URETHRITIS AND BARTHOLINITIS

On retracting the labia, the external urinary meatus appears as a reddened, elevated area. The mucosa is thickened and more or less everted. This is especially noticed in the labia of the urethra. The exit to Bartholin's gland on the right side is reddened, and presents the typical appearance of a gonococcal macule. A small drop of pus is seen exuding. As a result of the irritating discharge, the vulvar orifice is seen to be more or less inflamed. The infection of the crypts about the urethra is well illustrated.



from the glands, but this point can be definitely located by means of a cystoscope, or the patient may be instructed to urinate and the urethra then be milked. Urethritis may be caused by organisms other than the gonococcus. Sippel<sup>1</sup> has recently directed attention to the infection of the urethra by the colon bacillus which often occurs shortly after marriage.

**Treatment.**—Urethritis tends to become chronic, and in rare cases may eventuate in cure without any treatment whatever. Nevertheless, judicious treatment tends to shorten the duration of the acute attack. If they do not receive treatment, the chronic cases often run an almost interminable course, and are a constant source of danger both to the patient and to others. It is this type of case in which treatment is particularly necessary and which is too often neglected. The necessity of continuing treatment until an entire cure has been obtained cannot be overrated. The fact that at this stage subjective symptoms are usually absent increases the difficulty of securing persistent treatment.

During the acute stage it is advisable to keep the patient in bed. If this cannot be done, she should be instructed to avoid all exercise and take as much rest in the recumbent position as possible. The diet should be restricted, especial care being taken to exclude all highly seasoned, greasy, or fried foods; coffee, tea, acid fruits, and vegetables should be interdicted. Alcohol in all forms must be avoided. Skimmed milk is highly recommended. An abundance of water should be drunk, with the object of procuring a bland urine. Mineral waters are often beneficial in these cases, not so much perhaps from any actual medicinal properties they may possess, as from the fact that patients are thus induced to drink large quantities of liquid. To guard against cystitis, small doses of salol, cystogen, or boric acid, or combinations of these, may be employed. The bowels should be regulated and occasionally flushed by the use of salines. The use of rectal enemata is contraindicated in all gonorrheal conditions about the external genitalia, because of the danger of infecting the rectum. Hot sitz-baths often tend to alleviate pain when this is pronounced. Great care should be exercised in the employment of local treatment not to contaminate uninfected organs, and this is particularly true of children. If the cervix is coincidentally infected, a copious weak antiseptic douche should be administered two or three times daily. If, however, the cervix and vagina are normal, every precaution should be exercised to keep them so, and no vaginal douches should be given.

In all forms of urethral treatment care must be taken not to carry

<sup>1</sup> Sippel, A.: Deut. med. Wochenschr., June 13, 1912.

the infection from the urethra to the bladder. During the acute stage cleanliness and irrigations of the external urinary meatus and surrounding vulvar structures with warm, weak antiseptic solutions are all that are usually necessary. As the acute symptoms subside, however, more active measures are indicated. These consist of irrigations of the urethra with various antibleorrhagics, among the best of which are protargol, 0.5 to 5 per cent.; argyrol, 5 to 30 per cent.; silver nitrate, 2 to 5 per cent.; ichthyol, 10 to 50 per cent. Protargol and argyrol, owing to the fact that they may be employed in stronger solutions and are less irritating to the inflamed mucosa, have largely superseded silver nitrate. The injections may be given with an ordinary medicine-dropper or pipet, care being always taken to confine the treatments to the urethra, and not to wash infective material into the bladder. The injection should be retained for from two to four minutes. The patient should be instructed to urinate just before the treatment is given and to refrain from emptying the bladder for at least one hour subsequently. If the urethra is found to be sensitive, or if the treatments cause much pain, the introduction into the canal of a small strip of cotton soaked in weak cocaine solution may precede the treatment. At the completion of the irrigation a small pledget of cotton soaked in the germicidal solution may, with advantage, be introduced a couple of centimeters into the urethra and left in place for half an hour or longer. If this causes much pain or irritation, a urethral bougie may be substituted for it. These bougies are made of lanolin or cacao-butter, softened with a little oil, to which is added protargol, argyrol, or ichthyol, as the case may seem to demand.

As a vehicle for applying medications to the urethra the bougie possesses many advantages. After they are inserted the warmth of the tissues causes them to liquefy slowly, thereby permitting the medicament to come into intimate contact with the diseased mucosa for a long period of time. Moreover, the oily nature of the excipient insures the contact of the germicide for a sufficiently long time to permit it to exert its full effect, as the oil tends to penetrate to the deepest crypts of the urethra and to adhere to the mucosa.

Hofman<sup>1</sup> has used sodium bile salts as a pus solvent, with gratifying results, in a series of cases of urethritis in the male. He believes that the bile salts act particularly well in removing the pus and mucus, thus preparing the field for the application of silver or other germicidal preparations. To ascertain the efficacy of the treatment the urethra should be examined through a cystoscope, the canal being

<sup>1</sup> Hofman: *Wien. klin. Wochenschr.*, 1912, vol. xxv, No. 44, p. 1742.

first irrigated with an antiseptic solution, and care being taken not to introduce the instrument beyond the internal sphincter. To prevent this, the barrel of the cystoscope should not be inserted more than 2 or at the most 2.5 cm. Frequently, small red granular areas of ulceration will be found. These should be treated by direct applications, through the cystoscope, of strong solutions of silver nitrate—5 to 10 per cent. These applications should be made two or three times a week.

In most cases of chronic urethritis Skene's glands will be found to be infected. For the treatment of gonorrhea in this location a few drops of a 5 per cent. protargol solution may be applied, a hypodermic syringe with a blunt-pointed needle being employed, the end of the needle being inserted to the bottom of the gland. If this does not effect a cure in a reasonable length of time, the plan suggested by Skene may be used. This consists of introducing a fine probe to the bottom of the gland, and then cutting down on the end of the latter from the vaginal side by means of a cautery blade. The gland is then thoroughly burned out. This operation can usually be performed under local anesthesia. When the infected area can be easily reached, and when the external urinary meatus is large, Skene's glands may be opened and cauterized through the urethra.

In examining for evidence of infection in Skene's glands, or in the treatment, a good exposure is most necessary. Hunner<sup>1</sup> suggests the employment of two bent hair-pins held in hemostats for retractors. Taussig<sup>2</sup> prefers an Outerbridge intra-uterine pessary, which has the advantage of being self-retaining. This authority recommends injection of 10 to 20 per cent. silver nitrate solution into Skene's glands, and if the infection does not quickly yield to this treatment, the incision of the glands throughout their length through the urethra. If an abscess is present, this should be opened, and, if possible, the opposite gland incised at the same sitting. These operations can, as a rule, be performed under local anesthesia.

Stricture of the female urethra is of comparatively infrequent occurrence. It is generally annular in type, and situated near the external urinary meatus, although any part of the canal may be involved. The most marked symptom of stricture is frequent and difficult micturition. The incontinence of retention, so frequently observed in the male, may be present also in the female. Induration about the site of the stricture can usually be detected by palpation

<sup>1</sup>Hunner, G. L.: Kelly and Noble: *Gynecology and Abdominal Surgery*, Philadelphia and London, 1907, vol. i, p. 451.

<sup>2</sup>Taussig, F. J.: *Jour. Mo. State Med. Assoc.*, November, 1912, p. 137.

through the vagina, or the stricture may be located by means of a sound or with the urethroscope. If the stricture is located near the external urinary meatus, it may be seen by direct inspection. Not infrequently a stricture will manifest itself only when an old infection is lighted up or a fresh infection implanted upon the urethral mucosa. Strictures can usually be easily dilated. Forceful dilatation, with the patient anesthetized, and the subsequent daily passage of a sound for a short period, is usually preferable to gradual dilatation. In rare instances, owing to the density of the stricture, urethrotomy will be demanded, after which regular dilatation should be practised.

During the chronic stage of urethritis general treatment is of secondary importance. The urine should be kept bland by the means previously described. In this as in all other forms of gonorrhea of the genito-urinary tract the patients are best confined to bed during the menstrual periods, as the danger of extension of the disease is greatest at these times.

In itself, urethritis is frequently a very mild condition, the importance of thorough treatment depending not so much on checking the subjective symptoms as for prophylactic measures. For this reason no case of gonorrhea of the external genitalia should be pronounced cured until so proved by repeated negative bacteriologic examinations, conducted under circumstances favorable for the detection of the gonococcus.



## CHAPTER X

### GONORRHEAL VAGINITIS AND CERVICITIS

#### GONORRHEAL VAGINITIS

GONORRHEAL vaginitis, colpitis, or elytritis is a comparatively rare disease in the adult. Among pregnant women and during the puerperium the condition is more common. Sanger<sup>1</sup> states that vaginitis is more frequent in blonds than in brunets. This, however, has never been proved, and seems on a par with the somewhat similar statement made by Ricord, in 1832, to the effect that fair women were more inceptive to venereal infection than their darker sisters. Vaginitis may be primary or secondary, the latter form being, by far, the more frequent. The condition usually arises as the result of the constant contamination of the vagina by discharge from a gonorrheal cervicitis, or, less often, may extend upward from a vulvitis or a urethritis, which conditions, as a rule, accompany a specific vaginitis. The gonococcus is the microorganism that most frequently produces inflammation in this locality. The comparative infrequency of vaginitis in adults may be attributed to two causes, namely: the bactericidal properties of the vaginal secretion and the fact that the vaginal lining, which is often incorrectly spoken of as a mucous membrane, is, in general, similar in its histologic structure to the skin, except that in the former there are very few glands and the outer layer of epithelium is somewhat less fully developed. Because of this latter reason gonorrheal infection of this area is infrequent in adults, whereas in children, in whom the protective qualities of the lining membrane of the vagina are but poorly developed, gonorrhea is often encountered. That the vaginal secretion is destructive to pathologic organisms has been proved beyond doubt.

Doderlein believes that the acidity of the normal vagina is the result of the production of lactic acid by a special bacillus. This observer distinguishes between a normal and a pathologic vaginal secretion. The former is strongly acid, whereas the latter may be weakly acid, neutral, or even alkaline, and may harbor a large variety of bacteria, either pathologic or saprophytic, from which autoinfection may take place. This pathologic secretion is present in 50 per cent. of all cases of pregnancy, and is more apt to occur in the multipara,

<sup>1</sup> Sanger: *Verhandl. d. deutsch. Gesellschaft f. Gyn.*, 1889.

especially if the vaginal outlet is relaxed, than in the nullipara or the primipara. The demonstration of this fact has greatly simplified the study of the process of infection. The researches of Stolz<sup>1</sup> and Dubendorfer<sup>2</sup> have in the main confirmed Döderlein's conclusions regarding the bacteriology of the vagina. Labusquine<sup>3</sup> has also recently called attention to the importance of the acidity of the vagina.

At certain periods in a woman's life the vaginal secretion tends to become less acid, *e.g.*, at and immediately following menstruation, during the puerperium, and when a profuse leukorrhea is present—periods when it is well recognized, from clinical experience, that the genital tract is peculiarly inceptive to any form of infection, and, more especially, to the gonococcus. That the vaginal secretion has bactericidal properties is now well proved, although all Döderlein's conclusions are not universally accepted. Indeed, Krönig states that in his investigations he was unable to demonstrate the so-called pathologic secretion, and that the vaginal discharge was in all cases equally bactericidal. He believes that the diversity in results obtained is dependent not so much on the character and reaction of the vaginal secretion as upon the vitality and virulence of the germs. His investigations were made upon pregnant women. An important practical observation, reported by Krönig and since confirmed by other investigators, is that a solution of mercury bichlorid, when employed as a vaginal douche, destroys the germicidal property of the vaginal secretion, probably by causing a precipitation of albumin, whereas sterile water, employed in the same way, tends to lessen this property. Menge found that pathogenic germs in the vagina were destroyed in periods varying from two and one-half hours to three days. His investigations were conducted upon non-pregnant women.

Williams<sup>4</sup> states that, under normal conditions, pyogenic cocci are never present in the vagina of pregnant women. v. Rosthorn<sup>5</sup> believes that the vagina is not always sterile. Pankow<sup>6</sup> is of the opinion that in the normal woman there is a constant migration of organisms from the vulva to the vagina, but that in the latter the organisms are destroyed. At the outlet of the vagina a few germs are usually present, but become more and more scarce as the depth of the vagina is ap-

<sup>1</sup> Stolz: Studien zur Bakteriologie des Genitalkanals in der Schwangerschaft und im Wochenbett, Graz, 1903.

<sup>2</sup> Dubendorfer, E.: Bakteriologische Untersuchungen des Vulva und Vaginalsekretes, Inaug. Diss., Bonn, 1901.

<sup>3</sup> Labusquine, R.: Annal. de Gyn. et d'Obstet., August, 1912, p. 503.

<sup>4</sup> Williams, J. W.: Amer. Jour. Obst., 1898, vol. xxxviii; also Obstetrics, p. 775, New York and London, 1903.

<sup>5</sup> v. Rosthorn: von Winckel, Handbuch d. Geburtshülfe, 1903, vol. i.

<sup>6</sup> Pankow: Zeit. f. Geb. u. Gyn., 1912, vol. lxxi, No. 3.

proached. Pankow's observations bear out the teachings of Döderlein, Menge, and Krönig as to the self-disinfection of the vagina. Much investigation has been carried out for the purpose of determining this point. Pankow's conclusions represent the most modern view concerning the bactericidal properties of the vaginal secretion, and are accepted by the majority of investigators. Walthard found that streptococci from a pure culture may be injected into the ear of a rabbit without producing serious harm, but that if the ear was previously ligated and the resistance thus lessened, a virulent infection would result. He compares this finding with that obtained when pathogenic germs are introduced into the normal vagina and produce no infection. When, however, similar microorganisms are brought in contact with the genitalia immediately after the trauma and injury incident to labor a virulent infection may take place, a familiar example of which is the ordinary postoperative infection.

From what has been said it may be seen that although the vaginal secretion possesses definite germicidal properties that are more pronounced at certain times and that vary under different conditions, the exact cause or process by which the microorganisms are destroyed has not been conclusively determined. Lack of oxygen can hardly be considered an important factor, despite the fact that the bactericidal properties of the vaginal secretion are lessened in patients in whom the introitus is gaping, since many germs that are anaërobic are nevertheless destroyed. Nor can the bactericidal action be explained solely by the chemical composition of the vaginal secretion, as the reaction of the latter is found to vary quite markedly; neither does it seem probable that this destructive power is entirely dependent upon the action of a special bacillus, although some microorganisms are known to be antagonistic to others. According to Krönig, the germicidal property of the vaginal secretion is not due to the presence of leukocytes, as it has been found to continue after exposure to heat, which destroys the contractile power of these cells. Our present knowledge of this subject would seem to show that all these factors play a part in the protection of the vagina, not least among which should be mentioned the resistant power of the vaginal lining membrane, the paucity of glands in this location, the constant outward flow of the vaginal secretion, and its actual germicidal action.

The production of a gonorrheal vaginitis is usually dependent upon the repeated or constant application of the specific microorganisms to the parts, in conjunction with irritation or injury, or upon some general condition that lessens the resistance of the lining membrane. The latter is the cause of the frequency of vaginitis among

children, in whom the membrane is thin and the outer layers of the squamous epithelium are undeveloped. The frequency of vaginitis, either specific or otherwise, in the aged may be attributed to the atrophic changes that occur in the lining membrane of the vagina.

As has previously been stated, gonorrheal vaginitis in the adult is usually a secondary condition to infection of the cervix. The constant drenching of the lining membrane of the vagina with the discharge from a cervicitis tends to soften and macerate the protective vaginal epithelium, and is an important etiologic factor in the production of this form of inflammation, and also explains why the disease nearly always occurs secondarily. Indeed, Bumm kept gonococci in the vagina of an adult for twelve hours without producing a lesion. Sanger believes that the vagina is attacked only when the epithelium is delicate, thin, or of impaired vitality, such as is seen in the young, in the old, and during pregnancy. Mandl examined tissue taken from cases of acute gonorrheal vaginitis, and found that the squamous epithelium was invariably thinned, and that in many cases the papillae were almost exposed. The entire sections were deeply infiltrated with the products of inflammation, and gonococci were found throughout the thicknesses of the epithelium, many being within leukocytes. In some areas gonococci were observed in the subepithelial connective tissue. The gonococci were found to have penetrated most deeply in those areas in which the protective epithelium was thinnest.

**Symptoms.**—Gonorrheal vaginitis may be acute, subacute, or chronic, the last being much the most frequent in adults. In the acute variety the onset is characterized by burning pain and tenderness, which are usually referred to the vulva and the perineum. These are mild at first, but in a day or two they become quite severe, and are intensified by walking or exercise of any kind. At the outset the discharge is scanty and thin, but it soon becomes profuse, mucopurulent, creamy in consistence, greenish or yellowish in color, and in severe cases may be blood streaked. As a rule, defecation is painful. Patients occasionally complain of a sensation as of a foreign body within the vagina. Ardor urinae and frequency of urination, as well as other symptoms of a urethritis, are generally present. If complications, such as suppurative adenitis or intraperitoneal infection, are absent, the constitutional symptoms are, as a rule, mild. On examination the vulva is often found to be involved, and the urethra usually presents evidences of inflammation. The lining membrane of the vagina is swollen, reddened, and exquisitely tender. On palpation, the vagina will be found to be warmer than normally, and a vaginal pulse can often be felt. The affected parts, as well as the

introitus, will be bathed in secretions. The hymen or the caruncular myrtiformes are thickened, congested, and painful. The cervix will nearly always be found to be the seat of an inflammation, and occasionally the inguinal lymph-glands may be involved. The acute attack usually lasts for from one to three weeks, and if not properly treated, gradually merges into the chronic stage.

Gonorrheal vaginitis may be subacute from the onset, and may quickly verge into a chronic condition. In chronic vaginitis the symptoms are usually combined with those of chronic vulvitis, bartholinitis, and urethritis, by which conditions it is usually accompanied. At this stage all the symptoms of acute inflammation have disappeared, and the vagina is no longer tender. The lining membrane is slightly reddened and thickened, and in some cases small ulcers or areas of erosion may be present. Finger has described a form of gonorrheal vaginitis in which the vagina is studded with deep-red granules the size of a hemp-seed, which lend to the surface a roughened, granular appearance. This variety of vaginitis is most common in pregnant women or in those who are anemic or poorly nourished.

Small condylomatous-like outgrowths are sometimes observed in the vagina during the subacute or chronic stage. Some authors claim that these are characteristic of gonorrhea, whereas others believe that they may be produced by any long-continued irritation, and are merely the morphologic expression of chemical irritation of the papillæ and their epithelial covering. Indeed, in this connection Bumm<sup>1</sup> states that chronic vaginitis in the adult is not so much the result of an actual infection as of the chemical irritation resulting from a cervical discharge. Some authorities believe that the condition may be produced entirely by the toxins in the discharge. These substances alone undoubtedly play an important rôle in many cases.

During the chronic stage the leukorrhea is decreased in amount, and is thinner and less purulent than in the acute stage. The more or less intense pain that was present during the acute stage has now given place to itching or burning sensations, which are increased by walking or friction, and are relieved by rest in the recumbent position. Vaginismus may be present, and is especially likely to occur in hysteric, neurasthenic, or debilitated patients. Attempts at coitus, digital examination, or even the introduction of the douche-nozle may produce a spasm that involves, to a greater or less extent, all the muscles in the adjacent area. Vaginodynia is particularly likely to occur in those cases in which ulcerations or fissures complicate the vaginitis. Urethritis sometimes plays a part in the production of the spasm.

<sup>1</sup> Bumm: Quoted by Menge: *Handbuch der Geschlechtskrankheiten*, Vienna, 1910.

The various symptoms of vulvitis, urethritis, or inguinal adenitis may be present. During the acute stage gonococci in large numbers are present in the discharge, but later they are reduced in number and may be difficult to demonstrate bacteriologically. Exacerbations are not infrequent during pregnancy or menstruation, and are often erroneously regarded as fresh attacks.

**Diagnosis.**—Gonorrheal vaginitis must be distinguished from inflammation of the vagina due to other causes, among which may be mentioned exogenous irritation, such as is produced by pessaries, tampons, and the like; from irritating discharges, such as occur in cancer of the uterus; from a ruptured pelvic abscess that is discharging its contents through the vagina; from discharges from vesicovaginal, rectovaginal, or other forms of vaginal fistulas; and from uncleanness. An etiologic factor to be borne in mind in vaginal inflammations, especially among children, is the *Oxyuris vermicularis*, or seat-worm. The use of caustics; the presence of decubitus ulcers, such as are often found in cases of prolapse; mycotic infections; irritation of the parts by dysenteric discharges; the ordinary pyogenic microorganisms or the Klebs-Löffler bacillus—may all produce the condition. The general tendency at present is to regard all forms of vaginitis as dependent upon the action of microorganisms, foreign bodies, etc., only preparing the soil for subsequent infections.

The diagnosis of gonorrheal vaginitis is not usually difficult. The history of the case, the concomitant symptoms of gonorrhea of the cervix, Bartholin's glands, and especially of the urethra and possibly of the uterine appendages, and the absence of other etiologic factors, are usually sufficient to establish the identity of the disease. If the vaginitis occurs during the puerperium and the child manifests an ophthalmia, this is an almost certain indication of the etiology of the vaginal condition, while confrontation in some cases may be possible. As regards the bacteriologic demonstration of the gonococcus in the discharge, it should be remembered that this in itself is not sufficient proof of the existence of a vaginitis in the adult, as the specific microorganism may be recovered from the discharges in cases of gonorrhea of the cervix or endometrium. In order to demonstrate the point of origin of the specific microorganism in the vaginal secretions Schultze's method may be employed. This consists in thoroughly cleansing the vagina and external genitalia by means of irrigations and swabbing, and then inserting a tightly fitting tampon of sterile absorbent cotton against the cervix. If the secretion that collects in the vagina below the tampon contains gonococci, this is evidence that a specific vaginitis is present, whereas if the upper surface of the tampon is contaminated



and the vaginal secretion is found to be negative, the infection is obviously confined to the uterus or appendages.

**Treatment.**—This varies with the stage of the disease present. A thorough examination should first be made to ascertain the extent of the lesion and to determine whether it is primary or secondary. At this examination a specimen should be secured for bacteriologic investigation. If the condition is found to be secondary, treatment must be directed to the primary cause as well as to the vaginitis. In most cases, when the cervical or ureteral discharges are checked, the vaginal condition will improve almost at once. During the acute stage absolute rest in bed is indicated. The bowels should be moved daily, if necessary by the administration of a simple laxative, or an occasional dose of Epsom salts may be given. The diet should be similar to that recommended in acute vulvitis. As urethritis is usually an accompaniment of gonorrheal vaginitis, the patient should be instructed to drink large quantities of water, and the treatment directed for inflammation of the urethra should be instituted. If the suffering is severe, small doses of opium may be administered. Suppositories or enemata are contraindicated because of the danger of infecting the rectum. For purposes of cleanliness and in order to facilitate the local treatment it is usually advisable to shave the vulva. An aseptic vaginal douche, consisting of a gallon of some bland solution, should be administered twice daily. For this purpose sterile water, normal salt solution, or sodium bicarbonate (4 drams to the gallon) may be employed, or if it does not cause too severe pain, a weak antiseptic solution, such as lysol or creolin (1 dram to the quart), mercury bichlorid (1:8000), boric acid (1 dram to the quart), or boric acid and sodium chlorid (1 dram of each to the quart), may be substituted. The following preparation, known as the A. B. C. douche powder, forms the basis of an excellent vaginal irrigation that may be used in all forms of gonorrhea in which a douche is indicated:

R.	Ae. boric.....	3vj
	Phenolis.....	
	Pulv. alum. exsicc.....	aa 3j
	Ol. gaulth.....	5j
	Ol. menth. pip.....	℥ xxx
M.	S.—	Tablespoonful to a gallon of water.

The strength of this preparation may be varied, but for an ordinary vaginal irrigation the foregoing quantities will be found efficient. Polando<sup>1</sup> states that the efficacy of a vaginal douche depends upon its astringency—he recommends a 2 per cent. solution of alum. Next in order of merit this observer places a 4 per cent. solution of alcohol.

<sup>1</sup> Polando: Zeitschr. f. Geb. u. Gyn., vol. lxx, No. 1.



If there is no nurse in attendance, the patient should be instructed as to the manner of taking the douche. A fountain syringe holding four quarts should be employed. Glass nozles are preferable to those made of hard rubber, as they are more easily kept clean. Nozles should be of medium size, and have perforations at the side, so that a recurrent flow will be obtained. Nozles with an opening directly at the end of the bulb should never be employed, on account of the danger of forcing the irrigating solution through the cervical canal and thus infecting the uterine cavity. The nozles should be thoroughly washed with hot water and soap after use, and then placed in a wide-mouthed bottle filled with an antiseptic solution. This bottle should be deep enough to contain sufficient fluid entirely to cover the nozles. The douche-bag and tubing should be scalded well before and after use, and when not in use, should be preserved in a place where dust cannot accumulate. Only boiled water should be used for douching purposes. The medicament to be employed is best dissolved in a cup of hot water, and this mixture added to the required water in the douche-bag. By this method the drug is thoroughly dissolved and mixed with the water that is to be used. The water should, as a rule, have a temperature of from 105° to 110° F. The douche-bag should be hung at a height that will require fifteen minutes for two quarts of solution to run off, and twenty or twenty-five minutes for a gallon. As a rule, three or four feet is about the proper height. The douche should be taken with the patient in the recumbent posture, the hips being elevated. Care should be observed to keep the douche-nozle sterile. The labia should be separated before the nozle is introduced. A good plan is to have detailed directions for taking a douche printed and hand a copy to each patient. A douche-pan is essential. Under no circumstances should an irrigation be taken while the patient is on the toilet or in the bath-tub. The latter may seem an unnecessary warning, but many cases have been known to occur where this has been the custom.

The vulvar pads should be changed frequently and the soiled dressing burned. Prophylactic measures, as suggested under the treatment of vulvitis, should be carried out, especial care being observed lest the pus be carried to the eyes. As the acute symptoms being to subside, more active local treatment is indicated. Vaginal irrigations of weak antiseptic solutions may now be employed three or more times daily. Formalin (40 minims to the quart), creolin or lysol (1 per cent.), mercury bichlorid (1:8000), boric acid and sodium chlorid (1 dram of each to the quart), potassium permanganate (1 dram to the quart), or the A. B. C. douche are to be recommended for

this purpose. In addition to the vaginal irrigations, local applications are of service. These are best given with the patient in the Sims' or knee-chest position; after the vagina has become distended with air, which should occur as soon as the Sims' speculum is introduced, the entire lining membrane should be freely sprayed with one of the anti-blennorrhagics advised for the treatment of chronic vulvitis. Iodin, 2 grains to the ounce of 95 per cent. alcohol, answers very well for this purpose if the vagina be not too sensitive. The spray is more effective than simple swabbing, as by its means the solution is driven into all the crypts and folds of the vagina. In Polak's<sup>1</sup> clinic a saturated solution of picric acid has been employed with satisfactory results. In about 100 cases of gonorrhea of the vagina in which the gonococcus was found in pure culture, from three to five treatments with picric acid cleared the field entirely of the gonococci. The method employed was very simple: the vagina was thoroughly cleansed; a tubular speculum was introduced, and one or two ounces of a solution of argyrol were poured into the vagina. Then a suitable piece of gauze was soaked in a saturated solution of picric acid in glycerin and placed in the vagina.

If chronic ulcers or abrasions are present, these may be touched with the solid stick of silver nitrate. This treatment should be thorough, and repeated two or three times a week. After the evening irrigation it is often of advantage to introduce a vaginal tampon saturated in one of the following preparations: Ichthyol and lanolin (25 per cent. to 50 per cent.); argyrol (25 per cent.); protargol (10 per cent. to 20 per cent.); silver nitrate (2 per cent. to 5 per cent.); or formalin in glycerin and water (formalin, 30 minims; glycerin, 6 ounces; water, 14 ounces). Intelligent patients may be taught how to prepare and insert the tampons. For this purpose the antiseptic gelatin-coated tampons, filled with sterile wool, are best. In some cases, when the vagina is tender, ointments, such as carbolyzed vaselin (5 per cent.), boric acid in vaselin, or ichthyol (10 per cent.) and formalin, may be substituted for the more active antiseptics. The tampon should be removed in the morning before the douche is taken. In these cases Asch<sup>2</sup> employs bougies containing 5 to 20 per cent. of isoform, with excellent results. This drug is said to be especially efficacious in the treatment of vulvovaginitis in young girls.

In order to increase the amount of lactic acid in the vagina, Kuhn<sup>3</sup> recommends the application of sugar. This method is of value chiefly in the early stages of the infection, and does not prevent the employ-

<sup>1</sup> Polak: Personal communication.

<sup>2</sup> Asch: *Zentralbl. f. Gyn.*, vol. xxxiv, No. 12, p. 406.

<sup>3</sup> Kuhn: *Zeit. f. Geb. u. Gyn.*, vol. lxx, No. 1.

ment of other forms of treatment. The treatment of urethritis and other gonococcal lesions that may be present should not be neglected. It is important that these patients be kept under treatment until a complete cure has been effected, as gonorrhea in any form, but especially that of the cervix and vagina, is a frequent source of infection, and the patient herself is in constant danger of the disease extending upward toward the peritoneal cavity. The fact should not be lost sight of that the discharge from these cases is infectious, and every precaution should be taken to prevent contamination of others. If the patient is married, an effort should be made to have the husband examined and, if necessary, treated. Coitus should be interdicted, and when this is impossible, precautionary measures should be adopted.

#### VAGINAL CONDYLOMATA

These tumors may be present in the vagina, and may or may not accompany a vaginitis. They may be secondary to a gonorrhea of the cervix, or may extend inward from a vulvitis or from similar growths of the external genitalia. As compared with venereal warts of gonorrheal origin on the external genitalia, condylomata in the vagina are infrequent. The growths present the same general appearance as do those found on the labia or the perineum. Occasionally they are somewhat flattened, depending upon their location. These tumors are most frequently observed in the lower third of the vagina, although no part of the canal is exempt. If any doubt as to the nature of the growths exists, a microscopic examination will clear up the diagnosis. The treatment is similar to that recommended for condylomata of the external genitals. In extensive excisions care must be observed that the vagina is not unduly narrowed, either by the operation or by the subsequent scar. Concomitant gonorrheal lesions should receive appropriate treatment.

#### GONORRHEAL CERVICITIS

Gonorrheal infection of the cervix is usually of primary origin, although ascending infections, starting at the external genitalia, have been described. From its location, the cervix is obviously an area in which contamination, resulting, as gonorrhea usually does, from coitus, is most likely to take place. The portio vaginalis, being normally covered by squamous epithelium to or slightly above the external os, is unlikely to become primarily infected by the gonococcus, an organism that shows a strong predilection for the columnar epithelium. The canal is lined with columnar epithelium, and this is the area in which the infection originates in the nulliparous women,

so that the primary infection is usually an endocervicitis rather than a cervicitis. From here it may spread by continuity to the surface of the cervix immediately surrounding the external os, and upward to the endometrium and to the tubes and ovaries. The process of upward extension is usually checked, at least temporarily, by the constriction at the internal os. Other factors that tend to control the upward spread of the disease are the constant downward flow of the cervical and uterine secretions, the plug of cervical mucus, and perhaps the strong alkalinity of the uterine cavity, for it is well known that gonococci that have been accustomed to an even faintly acid medium do not grow well in an alkaline soil. The vaginal portion of the cervix is usually bathed in an acid secretion, whereas the uterine cavity is alkaline. The exact point at which this change in reaction occurs in the cervical canal varies in different cases. In a case of extensive bilateral laceration with marked eversion of the mucosa and gaping of the external os the acid reaction of the vagina naturally extends higher in the canal than in a nullipara in whom the cervical opening is small and contracted.

The cervix is one of the most frequent structures in the female genital tract to be invaded by the gonococcus, as shown by McCann<sup>1</sup> and others. Menge,<sup>2</sup> quoting the combined statistics of Bumm, Steinschneider, Fabry, Brünshke, Bröse, and Welander, found that the cervix was involved in 80 per cent. of acute and in 95 per cent. of chronic cases.

The disease may be acute or chronic, the latter being the more frequent form. Säger, Döderlein, and other authorities claim that gonorrheal cervicitis may be chronic from the beginning. This is denied by Menge. Theoretically, this observer is undoubtedly correct, but practically it is found that the virulence of the disease varies markedly, and that although all cases are probably acute at the onset, in some the initial symptoms are so mild as closely to approach the chronic type. This is true of gonorrhea in all parts of the genital tract.

When the disease is acute, the chief symptom is generally the presence of a profuse, thick, yellowish, purulent discharge, which contains polymorphonuclear leukocytes, lymphocytes, and epithelial debris, and that may at times be blood streaked. This exudate contains numerous typical gonococci. At this stage of the disease the cervix may be swollen and tender. At and surrounding the external os a soft, bright-red area will be found that is more prominent than

<sup>1</sup> McCann, F. J.: Trans. London Obst. Soc., 1896, vol. xxxviii, p. 244.

<sup>2</sup> Menge, K.: Handbuch d. Geschlechtskrankheiten, Vienna, 1910.

<sup>3</sup> Döderlein: Quoted by Menge: *Loc. cit.*

the surrounding tissue (Plate III), and may bleed slightly if traumatized by the examining finger. The edges of this area are not sharply defined, and small punctate spots may be observed extending from it over the adjacent portio. In the center of this area of inflammation is the external os, from which the mucosa of the canal may be seen protruding as a bright red spot of everted, thickened, and congested inflammatory tissue. Purulent, thick, tenacious secretion is nearly always present in the canal, and may be seen extruding from the external os. Pressure on the cervix usually causes pain. In those cases in which there has been an extensive laceration of the cervix a somewhat more complex picture is often observed. In addition to the usual evidences of laceration and eversion, the mucous membrane of the canal may be greatly swollen; the arbor vitæ may be unusually prominent, and the inflamed area will appear to be more extensive than if lacerations were not present. Constitutional symptoms are rarely marked and are generally absent. Slight tenderness and pain in the inguinal lymphatic glands and iliac regions at the menstrual periods is, according to Brettauer,<sup>1</sup> a frequent symptom of gonorrhea of the cervix or the external genitalia. This pain is often accompanied by a slight rise in temperature, and is distinctly different from the usual dysmenorrheic symptoms encountered in young women. Menstruation may be irregular and profuse. Gonorrheal cervicitis may be chronic almost from the outset. In the chronic stage leukorrhea is often the only symptom present. This discharge is not so profuse as in the acute stage, and is usually mucopurulent and whitish or yellowish in color. Gonococci in reduced numbers are present in the exudate, and can often be demonstrated only after prolonged search. In chronic cervicitis acute exacerbations are particularly likely to occur at and following the menstrual periods, during pregnancy, in the puerperium, or following unwise cervical manipulations, at which times the discharge is increased in amount and becomes more purulent. Gonococci can usually be demonstrated in the exudate at these periods, even in those cases in which numerous previous bacteriologic examinations have given a negative result. During the chronic stage pain is rarely observed, and tenderness is much less noticeable or may be absent. Menstruation may and frequently is irregular, and the flow may be increased in amount. Marked menstrual disturbances are, however, more likely to occur after extension to the corporeal endometrium. Profuse leukorrhea is, without doubt, a debilitating condition. The numerous reflex nervous symptoms, however, that are sometimes ascribed to this discharge should be ac-

<sup>1</sup> Brettauer, S.: Amer. Jour. Obst., September, 1911, p. 457.

PLATE III



ACUTE GONORRHEAL CERVICITIS AND URETHRITIS.

The cervix is normal or enlarged. The area surrounding the external os is reddened and congested. The reddened area blends gradually into the surrounding normal cervical tissue. The urethra is somewhat reddened and the mucosa everted.





cepted with great caution, as they are, as a rule, too vague to warrant much consideration. Cervicitis often causes sterility. The general appearance of the cervix is similar to that of the acute stage, but the condition is more chronic. Hypertrophy of the cervix is less frequent, and the congestion is not so well marked as in the acute stage. As a consequence of infection, the orifices of the cervical gland often become occluded, and small cystic formations that vary in size from that of a pinhead to a buck-shot or larger result. These cysts can sometimes be observed bulging out from the cervical tissue beneath the squamous epithelium of the portio, and can be palpated as hard, shot-like bodies. If punctured, the cyst will exude a drop of thick, tenacious mucus, which may or may not be purulent. Nabothian cysts may result in marked enlargement of the cervix, and are especially likely to be present in conjunction with extensive lacerations. In some cases of chronic gonorrhea of the cervix the lesions are so slight that they can be detected only with the greatest difficulty.

**Diagnosis.**—Cervicitis is usually readily diagnosed. To prove that the condition is of gonorrheal origin is, however, not always so easy, especially during the chronic stage. The history of the case and the application of suitable bacteriologic tests will generally clear up this point. When the gonorrhea is superimposed upon a laceration and eversion of the cervix, the diagnosis is sometimes rendered extremely difficult. The presence of a congenital erosion of the cervix may also complicate the clinical picture. It should always be borne in mind that in cervicitis of gonorrheal origin the urethra and Bartholin's glands are usually involved. Severe cases of cervicitis occurring in multiparæ may at times, on account of the discharge, irritation, and profuse menstruation, suggest tumor formation, especially carcinoma, and the differential diagnosis, even after the cervix is exposed, is not always easily made. Both lesions may bleed on touch, although carcinoma is more likely to do so. In carcinoma, however, the cervix is hard, whereas in cervicitis or in cervicitis with eversion it is soft. In the former there is an actual loss of tissue, whereas in the latter the diseased area is swollen and nabothian cysts are usually present.

The history, the age of the patient, the absence or presence of concomitant symptoms of gonorrhea in other parts of the genital tract, and the physical character of the lesions will almost invariably clear up the diagnosis. If any doubt exists, a histologic examination of a piece of excised tissue will furnish absolute proof of the character of the condition. Early tuberculosis of the cervix may also, in some cases, cause confusion. In this location, however, tuberculosis is ex-

tremely rare. Syphilis usually presents characteristics that differentiate it from gonorrheal cervicitis. In cases of doubt, the laboratory offers a means of positive diagnosis.

**Treatment.**—In acute gonorrhea of the cervix no local treatment, save cleansing vaginal irrigations of bland antiseptic solutions, is indicated. As exceptions to this, however, must be mentioned those rare cases in which the cervical lesions are discovered in their incipency, in which case the method of Polak<sup>1</sup> often gives excellent results. This consists in placing the patient in the elevated lithotomy position and pouring into the vagina, through a Ferguson speculum, a solution of 25 per cent. argyrol. The excess of the argyrol is then removed, and an absorbent cotton tampon saturated with a solution consisting of equal parts of glycerin and picric acid is applied to the cervix. This tampon is reinforced by another of lamb's wool. The tampons are left in place for twenty-four hours, and the treatment then repeated. By this method gonorrhea of the external portion of the cervix may often be cured in a short time, but when the disease has extended to the deep mucosa of the canal, the treatment becomes much less effective.

When gonorrheal cervicitis is chronic, every effort should be made to eradicate the disease. Whatever form of local treatment is instituted during the chronic stage, it is of the utmost importance, as a preliminary step, that the thick cervical mucus be removed, as its presence to a large extent nullifies the beneficial effects of all medication by acting as a protective medium for the gonococcus, and preventing the application from reaching the diseased areas. For this reason, before applications are directed toward the cervix, this structure should be exposed by means of a suitable speculum, and the portio and external os sprayed with an alkaline solution. This procedure should be followed by swabbing of the canal with pledgets of cotton until all, or nearly all, the mucus has been removed. To facilitate the treatment it is advisable to steady the cervix by grasping it with a double tenaculum forceps. The success of the treatment of cervical gonorrhea largely depends upon the thoroughness with which this preliminary cleansing is carried out. Dobell's solution or a solution of sodium borate and sodium bicarbonate, of each, 1 dram to 6 ounces of water, may be employed. For application to the cervix and cervical canal moderately strong antiseptic solutions give the most satisfactory results; among the best of these are tincture of iodine, pure ichthyol, silver nitrate, 1 dram to the ounce, zinc chlorid, 20 to 50 per cent., or formaldehyd, 37 to 40 per cent. Since the cervix

<sup>1</sup> Polak: Personal communication.

is practically non-sensitive, these solutions may be applied with impunity without causing pain. After the removal of the thick, tenacious cervical mucus the vagina should be protected by the application of vaselin, and the cervix and canal dried with pledgets of absorbent cotton, and a piece of cotton or small gauze sponge placed posterior to the cervix. An applicator should then be wrapped with a thin layer of absorbent cotton and the solution applied to the diseased area and to the canal. Care must be taken not to insert the applicator beyond the internal os, but it should be pressed in every direction against the cervical mucosa. Sufficient medication should be used to reach all the crypts in the canal. If tincture of iodine, ichthyol, or silver nitrate solution is employed, a pledget of absorbent cotton or narrow strip of gauze saturated in this solution may, with advantage, be left in the canal for five or ten minutes, the vaginal speculum being meanwhile kept in place. When the external os is small, it is well to dilate the lower portion of the cervical canal prior to making the application, so as to permit the treatment to be more thoroughly applied. This dilatation may be effected with the solid metal dilator. Superficial cysts or nabothian follicles should be punctured with a spear-pointed bistoury or scalpel and their contents pressed out. This treatment should be followed by the introduction of a tampon, which may be left in place for from ten to fourteen hours. The cervical portion of the tampon should be saturated with one of the following solutions: Ichthyol, 25 to 50 per cent.; argyrol, 25 per cent.; or protargol, 10 to 25 per cent. For office work the tampons put up in gelatin capsules, now manufactured by the various supply houses, are not only convenient, but are especially efficacious, as none of the solution is squeezed out during the process of introduction. These treatments should be given once, twice, or thrice a week. Applications should be begun three or four days after the cessation of menstruation, and are best discontinued a few days before the expected onset of a period. The patients should be instructed to take three vaginal douches daily, except during menstruation: one in the morning on arising, one in the middle of the day, and the last before retiring at night. (For the technic of administering vaginal douches see under the Treatment of Vaginitis.) A vaginal douche should not be administered while a tampon is in place. The irrigation should consist of solutions similar to those recommended for chronic vaginitis, the best of which, perhaps, is the A. B. C. douche. Strict asepsis should be maintained throughout the treatment. Even after apparent cure has taken place the treatment should be continued for some weeks. A case should be considered cured only after all

clinical symptoms have disappeared and at least three consecutive negative bacteriologic examinations, conducted under circumstances favorable for the detection of the gonococcus, have been performed.

Brunet<sup>1</sup> reports good results from the use of pure picric acid in these cases, and Abraham<sup>2</sup> recommends bougies containing yeast and asparagin. The latter has treated 200 cases of gonorrhea of the cervix or vagina with yeast, and believes that by this method better results are obtained than by the employment of any other means. His method is first to clean and dry the parts, and then to insufflate powdered yeast over the vaginal walls and cervix. As a final step, a glycerin suppository containing 3 grams of yeast powder is inserted against the cervix. This method is especially efficacious in the treatment of vulvovaginitis of children. As the result of experiments, Abraham found that when gonococci are brought in contact with yeast, they are destroyed in six hours; hence he believes that yeast possesses a positive bactericidal power.

Martin<sup>3</sup> employs sterilized yeast applied on a tampon, and especially recommends its use in cases of gonorrhea of the cervix complicating pregnancy. The yeast is unirritating. This investigator prefers sterile normal salt solution for vaginal irrigation. Menge,<sup>4</sup> on the other hand, states that yeast has been employed more or less extensively by himself and his assistants in his clinic. No definite cure by the use of yeast alone has ever been obtained in any of their cases. Wagner<sup>5</sup> recommends irrigation of the cervix by means of hot water. He employs a wire frame to distend the vagina, and irrigation with large quantities of hot sterile water once daily, 20 to 25 liters at 45° C. being employed at a treatment. Once a week mucus from the cervix is examined for gonococci, and the treatment is continued until no specific organisms have been found on three consecutive examinations. In 85 per cent. of Wagner's cases the gonococci had disappeared in from twenty-six to thirty-five days, and by the ninetieth day in all others. The method seems to be peculiarly effective for gonorrheal vaginitis in little girls. Watson<sup>6</sup> recommends the treatment of gonorrheal cervicitis by lactic-acid bacilli. The preparation that he employs is made by filtering "Saurkultur" made of skimmed milk. Filtering separates the casein and leaves a slightly opaque whey, which contains large numbers of lactic-acid bacilli as well as lactose, lactalbumen,

<sup>1</sup> Brunet: *Poitou med.* Poitiers, 1910, vol. xxv, pp. 10-12.

<sup>2</sup> Abraham: *Monats. f. Geb. u. Gyn.*, vol. xxxi.

<sup>3</sup> Martin: *Berlin. klin. Wochenschr.*, 1904, No. 13, p. 325.

<sup>4</sup> Menge, K.: *Hand. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>5</sup> Wagner: *Berlin. klin. Wochenschr.*, Berlin, December 25, 1911, No. 52.

<sup>6</sup> Watson: *Brit. Med. Jour.*, January 22, 1910.

and salts. The solution thus obtained can be strengthened, by the addition of powdered lactic acid if deemed necessary. Watson first thoroughly cleanses the cervix and then applies the lactic-acid solution. The treatment is administered daily. He reports excellent results from this treatment. Nassauer<sup>1</sup> strongly urges the dry treatment of cervical gonorrhea, and states that he utilizes this method in nearly all cases in which he formerly used tampons. He employs bolus alba because it is an impalpable powder and has a high absorptive power.

Constitutional treatment is not usually required in gonorrheal cervicitis. The bowels should be regulated and general hygienic measures instituted. In the debilitated or anemic, tonics containing iron and strychnin are indicated. Von Franque<sup>2</sup> recommends that mud-baths be taken twice a week. It is especially important that these patients be kept in bed during the menstrual periods. If this is found to be impossible, they should be confined to their rooms and all unnecessary exercise be interdicted; all forms of local treatment should be discontinued, and every effort be made to prevent the disease from spreading to the body of the uterus.

Gonorrheal cervicitis is often extremely intractable, and persists despite all palliative measures that may be adopted. If this is found to be the case, trachelectomy will have to be resorted to. Amputation of the cervix offers the best hope of cure in those cases in which palliative methods fail to produce satisfactory results after a fair trial. Hunner<sup>3</sup> recommends the destruction of the cervical glands by the actual cautery. The method he employs is suitable for office use, and does not require the administration of an anesthetic. His technic is as follows: With the patient in the dorsal position, a broad-bladed Sims' speculum is introduced and the anterior lip of the cervix grasped with a tenaculum and pulled down as far as possible. The nurse or assistant stands at hand with the heated cautery. On handing the cautery to the operator the assistant continues to work the bulb with one hand, while with the other she retracts the speculum. The operator steadies the cervix with the tenaculum and manages the cautery with the other hand. The strokes should be made one at a time, the cautery being removed from the vagina after each application, as the patient feels the radiated heat on the vaginal walls. The patient should be warned that she will feel the heat, but must be told not to move, as there will be no pain. An exception to this rule is found

<sup>1</sup> Nassauer: *Münch. med. Wochenschr.*, 1912, No. 10 and 11.

<sup>2</sup> Von Franque: *Centrabl. f. Gyn.*, 1906, No. 34.

<sup>3</sup> Hunner: *Jour. Amer. Med. Assoc.*, January 20, 1906, p. 191.

in those patients who are suffering from a painful cervical scar. When this condition is present, Hunner advises a preliminary application of 20 per cent. cocaine solution. Five or six strokes are made at each sitting. The strokes are radiating, and are from 2 to 5 mm. in depth, and vary in length according to the case. Treatments are given once in three weeks. Occasionally slight bleeding follows the treatment, and as a precautionary measure, a strip of gauze may be left in the vagina for twenty-four hours following the cauterization. Discharge is usually profuse for a few days following the treatment. An average of ten treatments are required.

Schindler<sup>1</sup> believes that the uterus possesses a definite rhythmic automatic movement not influenced by the central nervous system, and that this action accounts for many of the endometrial and adnexal gonorrheal infections. His conclusions are based upon an extensive series of experiments which he has reported in detail. Atropin has been found to paralyze these movements. He therefore recommends that this drug be administered in the acute stage of gonorrheal infections, and at such times as extension upward is likely to take place, as, for example, after the emptying of a pregnant uterus in a patient known to have a cervical gonorrhea. Drenkhahn<sup>2</sup> also employs this drug in puerperal cases. Schindler<sup>3</sup> has employed atropin extensively in a large series of acute gonorrheal lesions, and has never observed any ill effects following its use, and believes that it is of great benefit to such patients.

#### PRURITUS VULVÆ

Itching or burning of the external genitalia may occasionally be secondary to gonorrhea of the upper genital tract, producing a profuse discharge. Mild degrees of pruritus vulvæ are by no means infrequent, especially in neglected cases, and in children may lead to masturbation. The author has never seen any very severe cases of this condition that were due to gonorrhea alone. Säger<sup>4</sup> believes them infrequent. When the discharge is checked, the condition rapidly disappears, and the only treatment usually necessary is that directed to the primary gonorrhea and the accompanying vulvitis. When the itching or burning is extreme, a temporary application of phenol and menthol, of each, 10 grains to the ounce, or 50 per cent. turpentine ointment, may be employed until the discharge is checked. Cleanliness is essential.

<sup>1</sup> Schindler, C.: *Arch. f. Gyn.*, Berlin, 1909, vol. lxxxvii, p. 607; also *Berlin. klin. Woch.*, 1909, vol. xlv, p. 1691.

<sup>2</sup> Drenkhahn: *Therap. Monatsh.*, February, 1905.

<sup>3</sup> Schindler, C.: *Loc. cit.*

<sup>4</sup> Säger: *Cent. f. Gynäk.*, 1894, p. 154.

## CONDYLOMATA OF THE CERVIX

Winter and Ruge<sup>1</sup> refer to condylomata of the cervix; the condition is, however, extremely rare. Until 1900 Cullen<sup>2</sup> had only observed one case, and this was associated with tuberculosis. The tumors occur most frequently during pregnancy, and resemble condylomata of the external genitalia or vagina. They vary in shape and are often pedunculated. They are usually secondary to cervical gonorrhea. On account of the rarity of condylomata of the cervix, all tumors springing from this location, and especially those that present a cauliflower-like appearance, should be subjected to histologic examination in order to exclude the possibility of cancer. Venereal warts of this area may be excised and the wound closed with interrupted catgut sutures.

<sup>1</sup> Winter and Ruge: Gynecological Diagnosis.

<sup>2</sup> Cullen: Cancer of the Uterus, 1900, p. 191.



## CHAPTER XI

### GONORRHEAL ENDOMETRITIS, METRITIS, AND INTRAMURAL UTERINE ABSCESS

#### GONORRHEAL ENDOMETRITIS

STRICTLY speaking, endometritis may be either cervical or corporeal. Although both forms of the disease may be set up by the same micro-organism, the pathology, symptoms, prognosis, and treatment are totally dissimilar. In a preceding chapter we dealt with gonorrheal inflammations of the cervix, and in order to avoid confusion these conditions were designated cervicitis and endocervicitis, in contradistinction to the term endometritis, which is here reserved for an inflammation of the corporeal endometrium.

The name endometritis was formerly used to cover practically all endometrial diseases except actual tumor formation. This led to much confusion and to many unnecessary and often actually harmful operations. Much of this confusion doubtless arose as the result of the indiscriminate histologic diagnosis made upon specimens secured by curetage, such as glandular, interstitial, fungoid, hyperplastic, or atrophic endometritis. Such diagnoses were usually based upon a misconception of the normal histology of the endometrium. Since the excellent monograph of Adler and Hitschmann,<sup>1</sup> whose findings were confirmed by Keene<sup>2</sup> and the author, a clearer understanding of the histology of the normal endometrium has resulted. It is now known that the changes in the endometrium run in a definite cycle, the details of which have been described under the Pathology of Endometritis. It is sufficient for present purposes to state that the mucosa removed shortly before a menstrual period will be found to be thick and present all the appearances of what was formerly frequently incorrectly designated as glandular or hyperplastic endometritis, whereas the post-menstrual endometrium will be found to be thin and of the type often spoken of as atrophic or interstitial endometritis. Another cause for confusion has been the application of the term endometritis to such endometria as are thickened or altered as a result of variations in the blood-supply and from causes other than actual inflammation.

<sup>1</sup> Adler and Hitschmann: *Monats. f. Geb. u. Gyn.*, 1908, vol. xxvii, No. 1.

<sup>2</sup> Norris, C. C., and Keene, F. E.: *Surg., Gyn., and Obstet.*, January, 1909, p. 44.

The general trend at present is to view all forms of endometritis as the products of bacterial infection, and in this opinion the author concurs. When, therefore, the term endometritis is used here, it will be intended to designate a condition induced by the direct action of bacteria or their toxic products upon the endometrium. As a result of our more accurate knowledge of the histology of the endometrium, we now recognize that inflammation of this structure, instead of being extremely frequent, as was formerly believed, is actually of comparative rarity. This is particularly true of the gonorrheal conditions unassociated with tubal inflammation.

Gonorrheal endometritis is always the result of an ascending infection, the cervix being invariably previously attacked. From the endometrium the disease may and often does spread to the tubes, where it produces the various inflammatory lesions of the adnexa. In the histologic examination of many endometria from cases of pyosalpinx the mucosa of the uterus was found to be normal in a considerable proportion of specimens, thus leading to the belief that in a certain percentage of cases gonorrhea in this locality undergoes spontaneous cure, although Bumm<sup>1</sup> and others have proved that the gonococci may in some instances lie dormant without setting up an inflammatory reaction. This latter explanation is doubtless the correct one in many cases. It seems probable that the resolution of the endometrium depends largely upon the perpendicular arrangement of the uterine cavity, which favors drainage, and the abundant blood-supply of the mucous membrane. Active inflammation of the endometrium is not infrequently kept up in cases of pyosalpinx by the leakage of pus through the intramural portion of the tube into the uterine cavity.

The actual frequency of endometritis is shown by the fact that in the Laboratory of Gynecologic Pathology at the University of Pennsylvania, the author has examined 995 endometria removed for various conditions, and among this number he found only 208 cases of endometritis, 12 being of puerperal origin, whereas 14 were tubercular. Of the 194 cases (tubercular cases excluded), including those of puerperal origin, 121, or 62.36 per cent., were, judging from the clinical symptoms, gonorrheal in origin. Of the 12 puerperal cases, 6 were associated with the presence of, and were probably caused by, the gonococcus. All the cases examined have not been subjected to bacteriologic tests, so that it is impossible to state positively the proportion of these infections that were of gonorrheal origin. Almost similar results regarding the frequency of endometritis are reported

<sup>1</sup> Bumm: Veit's *Hand. der Gyn.*

by Cullen, who states that during a period of four years in the Gynecologic Laboratory of the Johns Hopkins Hospital, there were only 48 cases of endometritis, or an average of one a month. When we consider that neither of these reports refers exclusively to gonorrheal conditions, the comparative infrequency of this type of infection of the endometrium is at once apparent. Of the 194 cases of endometritis previously referred to, 101 were associated with more or less involvement of the uterine musculature. Metritis must, therefore, be regarded as a frequent accompaniment of endometritis. Of the 141 cases of endometritis that were associated with inflammatory lesions of the tubes, and which, it seems fair to assume, may, at least in the large majority of cases, be considered of gonococcal origin, 71 were complicated by metritis. It is important to bear in mind the relative infrequency of endometritis compared with cervicitis, and the association of the former with metritis and often with adnexal lesions, in considering the treatment of this condition. In previous years a lack of knowledge of this point led to the indiscriminate employment of intra-uterine applications and the performance of curetments, which have often been followed by the most disastrous results in cases in which the source of the trouble really lay in the cervix. Leipmann<sup>1</sup> states that about 50 per cent. of the cervical gonorrheas eventually extend above the internal os. In the large series of cases reported upon by the Committee of Seven<sup>2</sup> invasion of the uterine cavity and adnexa had occurred in 40 per cent. of patients. Opitz<sup>3</sup> believes that not more than 10 per cent. of gonorrheas extend above the internal os.

Gonorrheal endometritis may be either acute or chronic, and varies in severity quite markedly in different cases. Chronic endometritis may result from an acute attack or may be practically subacute or chronic from the onset.

#### ACUTE GONORRHEAL ENDOMETRITIS

**Symptoms.**—The disease usually makes itself manifest shortly following a labor, miscarriage, or abortion, or just after a menstrual period. In some cases the infection of the endometrium occurs during menstruation, in which event an abrupt cessation of the flow may take place or the period may be prolonged or profuse. At the menstrual periods, and following the emptying of a pregnant uterus, the cervix is softened, the canal unusually patulous, and the plug of cervical mucus less occlusive, conditions that favor extension of the

<sup>1</sup> Leipmann: *Monats. f. Hautkrankh.*, 1904, vol. i.

<sup>2</sup> *Med. News*, December 2, 1909.      <sup>3</sup> Opitz, E.: *Medizinische Klinik*, January 8, 1911.

infection from below. In former years, when intra-uterine office manipulations and treatment were in general vogue, infection frequently resulted from such procedures by carrying infection from the cervix to the body of the uterus. Cameron<sup>1</sup> states that endometritis is likely to follow extra-uterine pregnancy. As the uterus during extra-uterine gestation undergoes, although to a lesser extent, many of the changes common to normal pregnancy, such as slight enlargement, slight softening of the cervix, etc., the etiologic relationship between the two conditions can easily be understood. In acute gonorrheal endometritis constitutional symptoms are, as a rule, present. The condition is sometimes ushered in by a chill, which is not often severe. Pyrexia is almost invariably present, although the temperature rarely rises above 101.5° F. The pulse ranges from 100 to 115, and the frequency of respiration is usually correspondingly increased. The concomitant symptoms of fever are present. Nausea and vomiting may occur, especially if the infection is a severe one. Diarrhea and rectal or vesical tenesmus may be present. Pain is not marked, but is nearly always complained of over the lower abdomen, chiefly in the region of the uterus. If the acute attack occurs during a menstrual period, irregularities are frequently observed, these usually taking the form of an excessive flow. The leukorrhea, which at the very onset may be diminished, soon becomes profuse. The discharge coming from the endometrium can be distinguished from that originating in the cervix by its thinness and the lack of the tenacious, glairy mucus that is so characteristic of the cervical secretion. As cervical gonorrhea is almost invariably an accompaniment of endometritis, the discharge from the body of the uterus and from the cervix are usually intimately mixed. In such cases the discharge is often very profuse, mucopurulent, or purulent in character, and in grave cases it is sometimes blood streaked. It is made up of mucus, serum, epithelial debris, and pus, and contains typical gonococci, which, during the acute stage, can usually be demonstrated without difficulty. At this stage a pelvic examination will disclose the fact that the uterus is slightly enlarged, uniformly softened, and tender, and the cervix hypertrophied and the canal more patulous than normal. Evidences of gonorrhea in the urethra or external genitalia are nearly always present, and gonococci may sometimes be recovered from these locations when their demonstration in the uterine discharge, by the ordinary methods, is difficult or impossible. Owing to the mixture of the cervical and corporeal discharges, but little dependence can be placed upon the demonstration of gonococci in the leukorrhea, unless

<sup>1</sup> Cameron: Brit. Med. Jour., 1909, vol. ii, p. 1028.

the material for examination is secured directly from the body of the uterus, a procedure that in most cases is hazardous.

**Diagnosis.**—Acute gonorrheal endometritis is to be differentiated from septic endometritis, the typical variety of which is produced by the streptococcus. The latter almost invariably follows as the result of contamination of the uterine cavity by manipulations, and is usually preceded by labor or miscarriage. Gonorrheal endometritis may be further distinguished from the septic form of the disease by the milder and more chronic symptoms of the former, the concomitant evidences of gonorrhea in other portions of the genital tract, by the presence of the specific microorganisms in the exudates, and by the tendency of the gonorrheal form to become chronic. Acute gonorrheal endometritis frequently extends to the tubes, but the positive diagnosis of this complication during the acute stage is often difficult. The points that would suggest a spread of the infection to the adnexa are extension of pain to the ovarian regions, severity and persistence of the symptoms, and the demonstration, by vaginal examination, of enlarged and tender tubal lesions. If a bimanual examination is performed at this stage, it should be carried out with the utmost gentleness, because of the danger of spreading the infection. Induration in the vaginal fornices, fixation of the cervix, and marked tenderness in these areas are signs indicative of an extension of the disease beyond the uterus. Small intra-uterine tumors, especially if they are undergoing degenerative changes, sometimes produce subjective symptoms similar to acute gonorrheal endometritis. Their differential diagnosis is, however, usually easy.

**Treatment.**—The treatment of acute gonorrheal endometritis is mainly expectant. The patient should be confined to bed. The bowels should be regulated by the use of mild cathartics and an occasional dose of the salines. The diet should be regulated, and should include the drinking of plenty of water. To aid drainage of the uterine cavity the patient may with advantage be placed in the upright Fowler position. If this is found to cause much discomfort, the position may be assumed for half an hour two or three times a day. The posture should be somewhat modified in the individual case according to the position of the uterus. Thus if the uterus is in ante-position, the extreme upright posture will not give so good drainage as if the patient is inclined slightly backward, while if the uterus is in retroposition, the perpendicular or the Sims left lateral posture is the most beneficial. No special medication by mouth is usually required. If the constitutional symptoms are marked or shock is present, stimulating treatment may be indicated. This, however, is not the rule,

as such symptoms are indicative of a streptococcic rather than of a gonococcal infection. If the temperature is high, cold sponges may be employed.

To relieve the pain and to hasten the subsidence of the inflammation ice-bags or ice-coils may be applied over the lower abdomen. In some cases the application of heat in the form of turpentine stupes or large poultices is preferable. Whichever method gives the greatest comfort to the individual patient is the one to be adopted. The external genitalia should be kept clean by the use of irrigations of weak antiseptic solutions, such as those previously directed in the treatment of vulvitis. If the discharge is profuse, cleansing vaginal irrigations of physiologic normal salt solution of a temperature of about 110° F. should be employed once or twice daily. During the early stages, or when the cervical canal may be widely open, the douches are best administered with the patient in Fowler's position, great care being exercised not to drive the fluid forcibly into the vagina for fear of washing the vaginal discharge into the uterine cavity. If any doubt exists as to the possibility of confining the irrigations to the vagina, douches had best be omitted at this stage. The chief indication is to keep the vagina clean. A sterile vulvar pad should be applied. All soiled dressings should be burned, and the precautionary measures recommended for the treatment of acute gonorrhea of the external genitalia should be instituted. Under this plan of treatment the acute symptoms usually subside in from five days to a week.

#### CHRONIC GONORRHEAL ENDOMETRITIS

This condition may occur as a sequela of an acute process, or may originate as a subacute attack. Like acute gonorrheal endometritis, the disease is always associated with gonorrhea of the cervix. Acute exacerbations may occur at any time, but are most frequent after abortion, miscarriage, labor, or at the menstrual periods, or the attacks may follow improperly applied intra-uterine manipulations or rough pelvic examinations.

**Symptoms.**—The chief symptom of chronic gonorrheal endometritis is the persistent leukorrhea. The discharge is less in amount and not so purulent as in the acute condition. At this stage of the disease it is often extremely difficult to distinguish between the discharge of a cervicitis and that of an endometritis. In the latter condition the discharge is whitish or yellowish in color, and thinner than that originating in the cervix, although, as a rule, the discharges are intimately mixed. Microscopic examination of the secretion shows that it is composed of serum, epithelial debris, leukocytes, and oc-

casionally a few red blood-corpuscles. According to Adler and Hitschmann,<sup>1</sup> and Norris and Keene,<sup>2</sup> normally no mucus is secreted by the endometrium except near the menstrual periods; any mucus that is present, therefore, is mainly of cervical origin. It is often only after repeated search that gonococci can be detected in the discharge. This is due not only to their scarcity in number, but also to the fact that the specific microorganisms are sometimes atypical in their morphology and staining properties in long-standing chronic cases. The demonstration of the gonococcus is useless so far as the diagnosis of an endometritis is concerned, as the microorganisms may have come from the cervix, as a result of an admixture of secretion from that locality. This, of course, does not apply to secretions obtained directly from the uterine cavity, but as the dangers of indiscriminate intra-uterine manipulations are so great, this test is of little practical value.

As a result of chronic gonorrheal endometritis menstrual disturbances, such as amenorrhea, menorrhagia, and metrorrhagia, are not infrequent. Irregularities as to date of the appearance of the flow and profuse menstruation are the most frequent manifestations. Dysmenorrhea is a common symptom and is usually of the congestive type, persisting throughout the first few days of menstruation. Occurring in women in whom menstruation has previously been painless, and in the absence of other gross lesions, and especially if gonorrhea of other portions of the genital tract exists, dysmenorrhea is a most suggestive symptom. Gonorrheal endometritis produces sterility, but exceptions to this rule are not infrequent. In those cases in which impregnation does take place, abortion often results. A pelvic examination of these cases reveals evidences of gonorrhea in the external genitalia or cervix, and in some cases, also, a slight enlargement and softening of the uterus may be detected. The enlargement and change in consistence of the uterus are dependent upon the degree of metritis that accompanies the endometritis, and are not usually sufficiently pronounced to be of much practical value as a diagnostic sign.

**Diagnosis.**—As will be observed from a review of the symptoms, the diagnosis of chronic gonorrheal endometritis is not easily made, the chief difficulty lying in differentiating between a cervical gonorrhea and a cervicitis combined with an endometritis. In attempting the differentiation, the frequency of cervical infection and the relative infrequency of cervicitis combined with endometritis without adnexal

<sup>1</sup> Adler and Hitschmann: *Monats. f. Geb. u. Gyn.*, vol. xxvii, No. 1.

<sup>2</sup> Norris, C. C., and Keene, F.: *Surg., Gyn., and Obst.*, January, 1909, p. 44.



involvement, should be borne in mind. When chronic gonorrheal endometritis is present, it is often associated with inflammations of the tubes, and only by careful pelvic examination can these complications be excluded.

**Treatment.**—Excessive exercise should be interdicted, and in some cases a course of treatment while the patient is confined to bed will be found beneficial. Rest should be especially enjoined for a few days previous to, during, and following the menstrual period, for, as has been stated, it is at this time that exacerbations and extension of the infection are especially likely to take place. The bowels should be regulated, and a nutritious and easily assimilated diet prescribed. If the patient is anemic, iron is indicated, and in debilitated subjects an endeavor should be made to build up the general health. Hot sitz-baths of salt water, given at night, are often of benefit, and are especially valuable in relieving the congestive pelvic pain that frequently precedes menstruation. Webster<sup>1</sup> recommends counter-irritation by means of blisters over the iliac regions. As regards local treatment, opinions vary widely. Formerly, intra-uterine applications were generally employed in office practice, and undoubtedly in many cases resulted in spreading the disease. Not only is there danger of mistaking a gonorrheal cervicitis for an endometritis and thus carrying infection to a previously normal uterine cavity, but even if the diagnosis is correct, there is considerable danger of causing an extension of the disease to the tubes. Another objection that may be made to this treatment is that a preëxisting salpingitis may be overlooked and an acute attack of pelvic peritonitis thus precipitated.

In a small proportion of patients the diagnosis of certain types of tubal lesions is extremely difficult, if not impossible, without the aid of an anesthetic. This proportion is doubtless small, but in the treatment of a large series of cases it constitutes a very grave objection to the ordinary routine method of making intra-uterine applications as generally performed in office practice. Such intra-uterine applications are painful and do no good. Emmet was one of the pioneers in pointing out the limited field of usefulness of intra-uterine applications as generally made. For these reasons, therefore, the author considers that intra-uterine applications or manipulations should not be performed in these cases unless the technic demanded by a major vaginal operation can be strictly carried out. This is usually impossible in office treatment and without the aid of an anesthetic. If, after a course of hot fomentations and vaginal douches extending over a period of at least six weeks, together with the local treatment

<sup>1</sup> Webster: *Diseases of Women*.

already indicated for gonorrhea of the cervix, the symptoms still point to an intra-uterine infection and show no signs of abating, the patient should be anesthetized and, after a careful pelvic examination has been made to exclude the possibility of adnexal complications, a thorough dilatation and curetage of the uterus and cervix, under strict antiseptic and aseptic precautions, should be performed. The cervix should be widely dilated in order to facilitate the intra-uterine manipulations. The endometrium of the sides of the uterus should be removed with a small Sims sharp curet, followed by a Recamier curet for the fundus and the portions about the tubal openings. The curetage should be done thoroughly and systematically, and every effort made to remove as much of the mucosa as possible. Clark has shown that it is impossible to scrape away the entire endometrium, especially that situated in the tubal angles and the deeper portions of the glands which sometimes penetrate the uterine musculature. Nevertheless, the gonococcus, being chiefly a surface microorganism, dezymotization of the uterine cavity can be accomplished in large measure. Following the curetage the uterine cavity should be wiped dry with strips of gauze. This will remove any débris that may have been left in the uterine cavity. It is not advisable to employ irrigation because of the danger of washing microorganisms from the uterine cavity into the tubes and thus spreading the infection. This is especially likely to occur in puerperal cases, or in those in which a metritis is present. Under such circumstances the uterine ostia of the Fallopian tubes may be relaxed in the general muscular relaxation of the uterus. The uterine cavity should then be painted with a strong solution of one of the antiblennorrhagies. For this purpose perhaps the best is the tincture of iodine. Polak strongly recommends iodine for all gonorrheal conditions, and in the author's hands it has given excellent results. It is important to have the tissue as dry as possible before applying the iodine. A strip of gauze saturated with the medicament should then be inserted into the uterine cavity and left in place for six hours. Bovée<sup>1</sup> states that curetage may be performed with impunity if thorough application of the full strength of tincture of iodine is applied efficiently and promptly to the endometrium, avoiding too much dilution by blood and serum. The danger of lighting up the latent infection in the endometrium by the curetage and iodination and thereby subjecting the previously healthy tubes to the danger of infection is practically nil. Unless followed by the application of a gonococcid, curetage should never be performed. Boldt<sup>2</sup> prefers to irrigate the uterus after the curetage, and follows this by

<sup>1</sup> Bovée, J. W.: *Amer. Jour. Obst.*, July, 1911, p. 101.

<sup>2</sup> Boldt: *Jour. Amer. Med. Assoc.*, February 1, 1908, p. 332.

packing the uterine cavity with gauze saturated with protargol solution. He removes the gauze in twenty-four hours and repeats the irrigation and tamponade on the third day. This is said not to cause much inconvenience to the patient if the cervical dilatation has been sufficiently effectual. Tweedy<sup>1</sup> follows the curetage by the application of 33 per cent. formalin solution, and leaves a gauze drain saturated in this solution in the uterine cavity for twenty-four hours. Prowe<sup>2</sup> follows the curetage by uterine tamponade of gauze soaked in pure ichthyol. Other authorities prefer applications of strong solution of silver nitrate or even pure phenol. If the latter is employed, its use should immediately be followed by an application of 95 per cent. alcohol. Following the operation the patient should be kept in bed for a week. For the first twenty-four hours it is preferable, for purposes of drainage, to have the patient in the Fowler position. Subsequently this posture should be assumed for one-half hour three or four times daily. Twenty-four hours after removal of the uterine gauze vaginal irrigations of some weak antiseptic solution, such as the A. B. C. douche, should be given and repeated two or three times daily. On the second and third day following the operation the discharge is usually profuse. After each defecation or urination the external genitalia should be irrigated with an antiseptic solution, and the vulva should be protected by sterile pads as long as the patient remains in bed or the discharge continues. Liquid food should be given for the first twenty-four hours following the operation, after which time a rapid return to full diet may be made. Little morbidity attends the operation of curetage if it is performed under proper aseptic conditions. The chief danger is the risk of setting up of a pelvic peritonitis through an extension of inflammation. When this occurs, it is usually the result of a preëxisting adnexal lesion that has been overlooked. When the cervix is badly diseased and in cases that have resisted palliative treatment, the curetage may be combined with a trachelectomy. In all cases the curetage should include a thorough scraping of the cervical canal with a sharp curet of the Volkmann type, and the free application of the germicidal solution to this area. It is hardly necessary to state that before the introduction of strong antiseptic solutions into the uterine cavity the vagina should be carefully protected by gauze or sterile vaselin. A time—four to five days—before an expected menstrual period should be selected for the curetage, as at this period the endometrium is thicker and softer and can be more thoroughly removed.

<sup>1</sup> Tweedy: Brit. Med. Jour., vol. ii, p. 1028.

<sup>2</sup> Prowe: Berlin. klin. Wochenschr., November 11, 1910.

The dangers of curetage in those cases complicated by tubal or adnexal lesions have previously been dwelt upon. This, however, does not apply to uterine treatments that are performed in conjunction with operations on the appendages. The after-treatment of cases in which curetage has been performed should consist of cleansing douches, and for a period of at least one month only the mildest forms of exercise should be indulged in. Menstruation is often somewhat irregular and profuse for one or two periods following the operation, and patients should remain in bed as long as the flow continues. For the treatment of menorrhagia Boldt<sup>1</sup> recommends the internal administration of cotarnin hydrochlorid, given in doses of three grains, in gelatin capsules, three times daily. Ergot, hydrastin, and viburnum prunifolium, or combinations of the three drugs, may also be employed. Douching should be omitted during menstruation. Coitus should not be indulged in until the disease has been eradicated, and precautionary measures, such as have been recommended in the treatment of gonorrhea of the external genitalia, should be instituted.

When the plan of treatment just outlined fails to effect a cure and it is certain that an endometritis exists, it may be found advisable to repeat the operation. This should not, however, be done until at least three months have been allowed to elapse. The histologic examination of the curetings obtained at the first operation will afford confirmatory evidence of a previously existing endometritis. The demonstration of gonococci in the endometrium in chronic cases of gonorrheal endometritis is difficult, and little importance can be attached to negative findings. In a few cases, after the operation, more or less profuse uterine bleeding and other symptoms of endometritis will persist, despite the treatment just described. In these cases, if the cervical canal is already dilated, intra-uterine applications, performed under the strictest aseptic precautions, are justifiable and sometimes beneficial. The contraindications to this plan of treatment are a history or symptoms pointing to inflammatory lesions of the adnexa, doubt as to the existence of an endometritis, or the presence of a tightly contracted cervical canal. A period shortly after the cessation of menstruation should be selected, as at this time the endometrium is thin and applications can, therefore, be expected to reach the deeper glands better than at any other time. The patients should be placed in the dorsal position, and the external genitalia and vagina thoroughly scrubbed with tincture of green soap and hot water, followed by a 1:2000 bi-

<sup>1</sup> Boldt: Jour. Amer. Med. Assoc., February 1, 1908, p. 332.

chlorid solution. If the green soap and water do not remove the cervical mucus, the cervix should be sprayed and swabbed with one of the alkaline solutions recommended in the treatment of cervical gonorrhea, and the soap and water again applied. The vagina should now be packed with gauze or cotton soaked in the bichlorid solution. This should be left in place while the operator makes the other necessary preparations. Then, under strict aseptic precautions, the cervix should be exposed through a large bivalve speculum, and the anterior lips grasped in a double tenaculum. Cotton pledgets or sterile vaselin are now placed in the vagina, to protect it from the action of the antiseptic that is to be employed. The applicators, which should have been previously prepared and wrapped with a thin layer of sterile cotton, are now dipped in the solution and applied. For this purpose, tincture of iodine is perhaps the most efficient drug, although formaldehyde (37-40 per cent.), silver nitrate (1 dram to the ounce), pure ichthyol, or pure phenol are preferred by some operators. The solution should be applied thoroughly to all parts of the uterine cavity, and especially to the tubal angles. If phenol is the chosen medication, its use should be followed by the application of 95 per cent. alcohol. It is necessary, as has been stated, that the solution employed reach all parts of the uterine cavity, and to attain this end it is advisable to prepare three or four applicators before beginning the treatment, so that they may be used quickly, one after the other, without the delay occasioned if only one applicator is at hand. If iodine is the antiseptic selected, an excellent plan is to precede the use of the applicators by the injection of a dram of the solution by means of an intra-uterine applying syringe, and follow this immediately by the insertion of cotton pledgets soaked in the same solution. The applications cause considerable pain, and for this reason it is necessary to complete the treatment quickly after the antiseptic is once applied, or the patient is likely to draw up on the table and make the remainder of the procedure difficult. The treatment should be concluded by introducing a sterile vaginal tampon saturated with boroglycerol or boric-acid ointment and the application of a sterile vulvar dressing. The pain caused by the intra-uterine application, as outlined above, lasts for but a few hours, and if unusually severe, may be alleviated by the administration of an anodyne. If the patient is of a nervous temperament, the pain may be temporarily relieved and the application facilitated by cocainizing the uterine cavity prior to the application.

The patient should remain quiet for three or four days following the treatment. She should be warned that the vaginal discharge

will probably be temporarily increased. As has previously been stated, it is important that husbands of such patients be made acquainted with the dangers of reinfection, and that cohabitation be interdicted until both husband and wife are absolutely cured. If it is found impossible to attain this end, precautionary measures should be adopted, and coitus enjoined for at least a week following the cessation of menstruation. For these cases, Dudley<sup>1</sup> has suggested an ingenious form of treatment. The device used is a tupelo sponge or sea-tangle tent, over the distal end of which has been attached half a gelatin capsule filled with whatever medicament may be selected for intra-uterine application. For cases of endometritis or metritis this observer recommends a powder consisting of one part of iodine crystals and two parts of potassium iodide, this being a proportion that dissolves readily in water. From two to four grains of this mixture are introduced at each treatment. The tent is sterilized by dry heat, and the gelatin capsule by the iodine, which is allowed to remain in the capsule for two days before it is used. The technic of the application is as follows: The vagina and external genitalia are cleansed as for an ordinary plastic operation. No general anesthetic is required. An applicator saturated with a 10 per cent. solution of cocaine is introduced into the uterus and allowed to remain in place for ten minutes. The cervix is then carefully dilated with a small Goodell dilator and the tent introduced. In about twelve hours the tent is removed, and, if it is thought advisable, a larger one may now be inserted. The advantages claimed for this method of treatment are that good dilatation is secured and the medication is applied to the endometrium for a prolonged period. Dudley recommends that the treatment be carried out in a hospital.

Intra-uterine applications in office practice have a limited field of usefulness, and the benefits to be derived from this plan of treatment are not, as a rule, great. The author does not, however, go so far as Boldt,<sup>2</sup> who stigmatizes intra-uterine treatment performed in office practice as "tinkering," but believes that the contraindications to such treatment should be rigidly adhered to, and that in all cases operative intervention, of the type described, will give far better results. Concomitant gonorrhea of the cervix, urethra, or external genitalia should receive appropriate treatment.

Vaporization has been employed by some operators in the treatment of chronic gonorrheal endometritis, with good results. The introduction of live steam into the uterine cavity is not without danger.

<sup>1</sup> Dudley, E. C.: Jour. Amer. Med. Assoc., June 24, 1911, p. 1874.

<sup>2</sup> Boldt: Jour. Amer. Med. Assoc., February 1, 1908, p. 332.



Many cases have been reported in which the uterine cavity has been accidentally obliterated, or in which adhesions between the anterior and posterior uterine walls have formed as a result. It is claimed for this treatment that it is applicable to all cases; that it is free from the danger of spreading infection, and that it is more thorough than curetage and the application of germicides. That vaporization is free from the danger of spreading infection has not been proved; in fact, the author believes that the risks attending this plan of treatment are quite as great as, if not greater than, those following curetage; he does not believe that the treatment is more thorough than that already described, as it is self-evident that it is impossible to remove all the endometrium without causing obliteration of the uterine cavity. One of the chief disadvantages to vaporization is the difficulty of accurately controlling the stream and ascertaining the exact depth to which the tissues are being destroyed. The endometrium in these cases varies quite markedly in thickness, and what would be sufficient steam completely to boil off the mucosa in one case, might only destroy the superficial layers in another.

Brindeau<sup>1</sup> has found the use of cultures of the lactic-acid bacillus of great value in various gynecologic conditions in which irritating discharges and inflammatory conditions are present. He has treated by this method 14 cases of endometritis and 78 additional patients suffering from various complaints. In endometritis the treatment is said quickly to overcome the offensive nature of the discharge.

#### ADENOMYOMA OF THE UTERUS WITH CHRONIC GONORRHEAL ENDOMETRITIS

Adenomyoma of the uterus is a comparatively frequent tumor. According to the statistics from the Laboratory of Gynecologic Pathology at the University of Pennsylvania, in a series of 395 myomatous uteri this tumor has been found 24 times, or in 6.7 per cent. of all cases. According to Cullen,<sup>2</sup> adenomyomata are found to constitute about 5.7 per cent. of all myomata. Cullen has shown that, in a large percentage of cases, the tumors are an ingrowth of the normal endometrium into the substance of either a discrete or a diffuse myomatous tumor; from this it would naturally be concluded that the endometrium in the neoplasms might be subject to an extension of inflammation from the uterine cavity, a fact that has been demonstrated in a few instances. The reason that the condition is not more frequently encountered is probably due to the fact that the gonococcus is mainly a surface microörganism, and that even in ordinary cases of

<sup>1</sup> Brindeau: *Arch. mens. d'obst. et de gyn.*, March, 1912.

<sup>2</sup> Cullen: *Adenomyoma of the Uterus*, 1908, p. 1.



endometritis the superficial portions of the mucosa are the areas chiefly involved. It would, therefore, follow as a matter of course that the deeper portions of the long glands and their surrounding stroma, which have grown far into the myomatous tissue, would be even less frequently diseased. Another factor that plays a part in the protection of adenomyoma from gonorrheal infection is that many of the glands in the tumor substance have been partially or completely cut off from the endometrial cavity by the constriction caused by the growth of the neoplasm, and are thus isolated from the source of the infection. Of the 24 cases of adenomyoma examined by the author, 7 were associated with endometritis, and in only 1 of these were inflammatory changes at all marked in the endometrial tissue of the tumor. All 7 cases of endometritis were accompanied by inflammatory lesions of the appendages. In the one specimen a moderate degree of inflammatory reaction was present in the myomatous tissue adjacent to the glands. The adenomyoma was of the diffuse type.

The symptoms of endometritis occurring in and with an adenomyoma of the uterus are those of uncomplicated adenomyoma of this organ, superimposed upon which are the evidences of an endometritis, as previously described. Beyond the diagnosis of an endometritis complicating a myomatous tumor of the uterus, probably adenomatous in character, a definite distinction as to the type of lesion present is impossible before the neoplasm has been subjected to a histologic examination. The treatment is, of course, operative, and should depend largely upon the individual case.

#### GONORRHEAL METRITIS

Inflammation of the uterine musculature may be either acute or chronic in character. The condition may be general, involving the entire uterus, or may be localized to certain portions, as in the case of abscess formation. (Owing to the diversity in symptoms and to the rarity of the lesion, intramural uterine abscesses will be described under a separate heading.)

#### ACUTE GONORRHEAL METRITIS

Acute gonorrheal metritis is always accompanied by an endometritis. If the latter is severe, the underlying muscular structures are almost certain to be involved. Metritis is especially likely to occur if the endometritis follow childbirth or miscarriage: the soft, involuting uterus offers little resistance to the microorganisms, and makes an excellent nidus for infection. Madlener<sup>1</sup> was one of the first observers to demonstrate the gonococcus in the uterine musculature.

<sup>1</sup> Madlener, M.: *Cent. f. Gyn.*, 1895, No. 50.

**Symptoms.**—These depend largely upon the grade of infection and the amount of resisting power of the individual. In the main, the symptoms are similar to those accompanying acute endometritis, and which have been described elsewhere. When metritis is present, the severity of these symptoms is likely to be augmented. The constitutional effects are more severe, and the disease does not yield so readily to treatment. The condition is usually ushered in with a chill, followed by nausea, vomiting, malaise, chilliness, or headache. The pulse-rate is increased, the temperature is elevated, the tongue becomes coated, the appetite is lost, and constipation is usually present, although sometimes there is diarrhea. If lactation is present, the secretion of milk may be diminished or abolished. The discharge is increased in amount, and is frequently of a dark, chocolate color, owing to the admixture of blood, but it may be yellow or even whitish. The uterus is uniformly enlarged, and is tender to the touch. Tenderness of the uterus and irregular and profuse menstruation are usually pronounced symptoms. Adnexal complications are more frequent than in uncomplicated endometritis. The cervix is invariably involved, and is usually the seat of a well-marked cervicitis. The cervical canal is generally markedly patulous and easily dilated.

**Diagnosis.**—When acute gonorrheal metritis follows pregnancy or abortion, the condition must be distinguished from septic metritis caused by the streptococcus or other pyogenic microorganisms. In the latter type of infection the symptoms are, as a rule, more severe, the pulse and temperature are higher, the general constitutional symptoms are likely to be more alarming, and the condition comes on earlier. In the gonorrheal variety, on the other hand, during the first few days following the emptying of the uterus the gonococci multiply in the superficial layers of the endometrium, whereas in the deeper layers there is an outpouring of leukocytes, forming a protective barrier of resistance. During this period the symptoms are not pronounced.

The **diagnosis** of acute gonorrheal metritis may be made from the evidences of gonorrhea about the external genitalia, urethra, and cervix, and from the bacteriologic demonstration of the infecting microorganism from these locations or in the lochia. The diagnosis of gonorrhea in the external genitalia does not, of course, preclude the possibility of a streptococcic infection existing in the uterus, but is strong presumptive evidence of the type of infection present. Furthermore, the gonococcus produces extension by way of the mucosa, so that if complications arise, the tubes are almost always affected, whereas if the infection is due to the streptococcus, cellulitis of the

broad ligament, with its accompanying symptoms, is often found. In gonorrheal metritis, especially if it follows the puerperium, adnexal complications are the rule. When following the emptying of a pregnant uterus, gonorrheal metritis must also be distinguished from autointoxication from the bowels and from lesions in the breasts, conditions that will be more fully dealt with in the chapter on Gonorrhea in the Puerperium.

**Treatment.**—This should be similar to that previously suggested for acute endometritis. As the constitutional symptoms are likely to be more severe, more active general treatment is indicated. If the uterus is large and boggy, the administration of ergot is often followed by good results, but the drug should not be employed if the presence of an abscess of the uterine parenchyma is suspected. The internal administration of atropin is said by Schindler<sup>1</sup> to be beneficial as a prophylactic measure against the spread of the infection, and may be employed in all acute gonorrheal infections of the uterus, as described in a previous chapter. The drug is given in the ordinary therapeutic doses. Pollock and Harrison<sup>2</sup> also report good results following the use of this drug. The patient should be kept in the Fowler position, to favor drainage of the uterine cavity. Local measures, as previously suggested for the treatment of acute endometritis, should be adopted.

#### CHRONIC GONORRHEAL METRITIS

This condition is always preceded by an endometritis. In some cases resolution may have taken place in the mucosa, and when such specimens are examined, the latter may appear to be comparatively normal, whereas the inflammation of the underlying musculature still remains. Chronic gonorrheal metritis may follow in the wake of an acute attack, or may be subacute from the beginning. The extent of the involvement of the uterine musculature varies widely in different cases. Thus in some patients only a slight subendometrial inflammation will be present, whereas in others the uterus may be found markedly enlarged, the chief pathologic lesion being very evidently in the uterine musculature.

**Symptoms.**—These are in general similar to those of chronic endometritis, but they are, as a rule, more pronounced. Theilhaber and Meir<sup>3</sup> believe that in many cases the leukorrhea and uterine hemorrhages that are said to result from an endometritis are in reality

<sup>1</sup> Schindler, C.: *Arch. f. Gyn.*, Berlin, 1909, vol. lxxxvii, p. 607.

<sup>2</sup> Pollock, C. E., and Harrison, L. H.: *Gonococcal Infections*, London, 1912, p. 122.

<sup>3</sup> Theilhaber and Meir: *Arch. f. Gyn.*, vol. lxi, No. 1, p. 1.

caused by lesions in the myometrium, and that metritis is more frequent than is generally believed. On pelvic examination of cases of metritis the uterus is found to be symmetrically enlarged and more or less tender on palpation. Both the enlargement and the tenderness are generally less marked than in the acute condition. According to Bell,<sup>1</sup> the muscular walls of the uterus, when infected during the puerperium, become bulky and hard (chronic "fibrotic" metritis).

**Treatment.**—This is similar to that suggested for chronic endometritis. For intra-uterine applications after curetage Diaz<sup>2</sup> and Webster<sup>3</sup> strongly recommend formalin. The author, however, prefers the tincture of iodin. If, after two or more curetments, the symptoms still continue to be severe, and especially if the uterine hemorrhages are intractable, a supravaginal hysterectomy and bilateral salpingectomy may become necessary. The plan suggested by Kelly, of excising from the fundus a V-shaped portion of the uterine wall, including the endometrium, may be advisable in some cases in which the appendages are normal and the patient is especially desirous of maternity, although the probability of the latter taking place is small. The chief advantage offered by this partial hysterectomy is that menstruation is not abolished. Kelly reports good results following this method.

Jayle and Loewy<sup>4</sup> have employed Bier's method of hyperemia in a number of cases, with satisfactory results. These authors have devised a glass tube with a syringe attached that aspirates when the piston is pushed into the cylinder, and thus creates a vacuum. This enables them to dispense with assistance, which otherwise would be necessary, the cupping-glass being held in one hand and the aspirator in the other. Each treatment lasts for about five minutes. The sittings are held daily, the number being regulated by the reaction elicited and the effect produced on the disease. The first application of Bier's cupping-glass to the cervix causes very decided pain in the pelvis and sacral regions, sometimes radiating to the thighs, but after a few treatments this pain disappears.

In those cases of metritis complicated by intractable uterine hemorrhages vaporization has been suggested as a means of either destroying the endometrium, or in severe cases of actually obliterating the uterine cavity. In the former event the operation offers no advantages over curetage, as previously described. As has

<sup>1</sup> Bell, W. B.: Principles of Gynecology, 1910.

<sup>2</sup> Diaz: *Annales de la Acad. de Obstet.*, etc., Madrid, 1910, vol. iii, p. 93.

<sup>3</sup> Webster: *Diseases of Women*.

<sup>4</sup> Jayle, F., and Loewy, R.: *Presse méd.*, Paris, 1907, vol. xv, p. 813.

been indicated, the difficulty of accurately controlling the stream within the uterine cavity is the chief obstacle to successful treatment by this method. We have no means at our command, unless the curet is employed, of determining the actual thickness of the endometrium. Therefore the amount of steam necessary to destroy one endometrium, might in another case be sufficient to remove all the mucosa and a part of the underlying muscle, and result in obliteration of the uterine cavity in an organ in which the lining membrane was thin, or might not remove sufficient tissue if the endometrium was greatly hypertrophied. Vaporization as a means of obliterating the endometrial cavity is justifiable only at the menopause, and even then, in the author's opinion, is inferior to hysterectomy, over which it offers no advantages, and the likelihood of such uteri subsequently producing distressing symptoms is very considerable. If even the intramural tubal mucosa is infected, vaporization offers no hope of cure. Flatau,<sup>1</sup> at a meeting of the Franconian Obstetrical Society, declared that from his own ten years' experience, and from that of others, the cases in which vaporization was justifiable before the menopause must be most exceptional. The same author further stated that vaporization should be used only when the strongest indications exist, and that the absolute obliteration of the uterine cavity cannot be insured without the employment of the soundest technic. On the other hand, Frankenstein<sup>2</sup> reports that he has applied vaporization 192 times in the Kiel Frauen-Klinik under Werth, for various conditions, with good primary results. He states, however, that in young patients, vaporization is not justifiable except under very exceptional circumstances. He believes that with carefully considered indications and accurate technic vaporization may be employed successfully in the treatment of hemorrhages at the climacteric.

Gellhorn,<sup>3</sup> Polano,<sup>4</sup> Hörrmann,<sup>5</sup> Lewicki,<sup>6</sup> Stöckel,<sup>7</sup> Jung,<sup>8</sup> Eltze,<sup>9</sup> Wagner,<sup>10</sup> Hasenfeld,<sup>11</sup> Fett,<sup>12</sup> Peham and Keitler,<sup>13</sup> Keilmann,<sup>14</sup> and

<sup>1</sup> Flatau, S.: Samml. klin. Vortr., Leipzig, 1910, n. f. No. 585.

<sup>2</sup> Frankenstein: Monats. f. Geb. u. Gyn., No. 2, p. 102.

<sup>3</sup> Gellhorn, G.: Amer. Jour. Obstet., 1909, vol. lx, No. 1.

<sup>4</sup> Polano: Zentralbl. f. Gyn., 1901, No. 30.

<sup>5</sup> Hörrmann: Monats. f. Geb. u. Gyn., 1907.

<sup>6</sup> Lewicki: Zentralbl. f. Gyn., 1906, No. 7, abstract.

<sup>7</sup> Stöckel: *Ibid.*, 1905, No. 48.

<sup>8</sup> Jung: Münch. med. Wochenschr., 1905, No. 52.

<sup>9</sup> Eltze: Zentralbl. f. Gyn., 1907, p. 1602.

<sup>10</sup> Wagner: Naturforscherversammlung, Dresden, 1907.

<sup>11</sup> Hasenfeld: Wien. klin. Wochenschr., 1907, No. 18.

<sup>12</sup> Fett: Monats. f. Geb. u. Gyn., 1905, p. 674.

<sup>13</sup> Peham, H., and Keitler, H.: Beit. z. Geb. u. Gyn.; Rudolf Chrobak, 1903, p. 626.

<sup>14</sup> Keilmann: St. Petersburg. med. Wochenschr., 1904, No. 28.

many others have employed dry heat for cases of metritis. This form of treatment is claimed to be especially beneficial in those cases that are accompanied by exudative processes within the pelvis. The presence of adnexal lesions do not contraindicate this treatment; it should, however, be employed only in chronic cases, and in those in which the temperature and pulse are normal. The treatments should always be administered under the control of a physician. Gellhorn<sup>1</sup> has devised an excellent apparatus for the application of the hot air. This instrument is a modification of Kehrer's<sup>2</sup> apparatus, and consists of two semicircular cradles made of thin sheet-iron, and covered on the inside with asbestos. These two cradles lie one upon the other, and may be pulled apart in the fashion of a telescope. On the inside of the free edges eight electric-light bulbs are attached, and a long wire furnishes the connection with the nearest switch. A hole in the roof of the cradle is provided for the thermometer. This instrument, in Gellhorn's hands, has given excellent results. The mode of application is as follows: The apparatus, with the thermometer adjusted, is placed over the exposed abdomen and the electric light turned on. As it is best to apply the heat gradually, the apparatus is not covered with blankets for a few minutes. A temperature of 200° to 220° F. is usually employed. An ice-bag or a cold cloth is placed on the patient's head, and she is urged to drink large quantities of cool water. In about ten minutes the temperature reaches 180° F., and some patients will complain of intense burning. The operator should be guided by the sensation of the patients, and should discontinue the treatment if it causes much discomfort. As the treatments advance, higher temperatures can usually be borne. All observers state that pain rapidly decreases, and a complete cessation of discomfort occurs after four or five treatments. In a certain proportion of cases there is only subjective improvement, but in the vast majority a diminution in the size of the exudate rapidly takes place. Polano<sup>3</sup> saw an old exudate of stony consistence, extending laterally to the right iliac bone, and upward to the umbilicus, disappear completely after 20 treatments. In one of Burger's<sup>4</sup> cases a tumor reaching as high as the umbilicus was reduced by 18 treatments to a single cord the size of the finger. Keilmann<sup>5</sup> reports 50 cases; Peham and Keitler,<sup>6</sup> 126 cases, and Fett,<sup>7</sup> 38 cases, the great majority of which were greatly improved or cured by this treatment. Sixty-five per cent. of Fett's<sup>8</sup>

<sup>1</sup> Gellhorn: *Loc. cit.*

<sup>2</sup> Kehrer: *Zentralbl. f. Gyn.*, 1901, No. 52.

<sup>3</sup> Polano: Quoted by Gellhorn: *Loc. cit.*

<sup>4</sup> Burger: Quoted by Gellhorn: *Loc. cit.*

<sup>5</sup> Keilmann: *Loc. cit.*

<sup>6</sup> Peham and Keitler: *Loc. cit.*

<sup>7</sup> Fett: *Monats. f. Geb. u. Gyn.*, 1905, p. 674.

<sup>8</sup> Fett: *Loc. cit.*



patients were cured, 7 per cent. improved, and 15 per cent. unimproved. Of Peham and Keitler's<sup>1</sup> cases, 58 per cent. were entirely cured, and 20 subsequently became pregnant. Treatments should be discontinued if an exacerbation of the inflammation occurs.

In cases in which exudative processes are a marked feature Kirsten<sup>2</sup> advocates the injection, into the exudate, of normal salt solution, to promote its absorption. He has employed this treatment in three cases with good results, but, as he himself observes, the patients might have recovered as promptly if he had not resorted to this treatment. Mocquot and Mock<sup>3</sup> recommend the injection of 30 to 40 per cent. solution of zinc chlorid. As the injections are painful, a preliminary injection of a 5 per cent. solution of cocain or novocain is advised. They report excellent results. The author has had no experience with this form of treatment, which is advocated by so many French surgeons. The injection of a more or less toxic solution into the base of the broad ligaments, or even into the parametrium, does not seem a sound mode of treatment, and it would appear that the patients recover despite, rather than because of, the injections.

#### GONORRHEAL INTRAMURAL ABSCESS OF THE UTERUS

Gonorrheal intramural abscess of the uterus is an extremely rare condition. This may be explained by the fact that, as has been stated, the gonococcus is mainly a surface microorganism, and therefore does not usually obtain access to the uterine parenchyma. In 1892 von Franque,<sup>4</sup> in an excellent monograph, reported 15 authentic cases of intramural abscess. The bacteriologic cause was not satisfactorily demonstrated in all cases, but 7 of them were dependent for their origin upon an infection following childbirth, so that it seems fair to assume that only the minority of these were gonococcal in origin. Five years later Noble<sup>5</sup> briefly reported 4 cases of abscess of the puerperal uterus, making in all 8 that had occurred in his practice. He also reviewed 11 other cases collected from the literature. The following year Mercade<sup>6</sup> reviewed the literature on this subject, and was able to find 41 authentic cases, of which 22 followed parturition, whereas in a recent paper Risch<sup>7</sup> reviews 22 cases. Beyer<sup>8</sup> reports the history

<sup>1</sup> Peham and Keitler: *Beit. z. Geb. u. Gyn.*, 1903, p. 626.

<sup>2</sup> Kirsten: *Zent. f. Gyn.*, December 25, 1909.

<sup>3</sup> Mocquot and Mock: *Rev. de Chir.*, 1912, No. 5, p. 779.

<sup>4</sup> von Franque: *Samml. klin. Vorträge*, new series, No. 316.

<sup>5</sup> Noble: *Trans. Amer. Gyn. Soc.*, 1906, vol. xxxi, p. 296.

<sup>6</sup> Mercade: *Annal. de Gyn. et d'Obstet.*, 1907, second series, vol. iv, p. 29.

<sup>7</sup> Risch: *Medizinische Klinik*, 1911, No. 5.

<sup>8</sup> Beyer: *Monats. f. Geb. u. Gyn.*, vol. xxxi, No. 4.



of a case, probably of streptococcic origin, which occurred four and one-half weeks after the delivery of the patient. Hysterectomy was followed by recovery. It is impossible to estimate accurately, from the foregoing reports, the proportion of these cases that were of gonorrheal origin.

Lea<sup>1</sup> reports a case occurring in a multipara following labor. This patient, during the last months of pregnancy, had a profuse leukorrhea. Labor was normal. The child developed ophthalmia. The patient convalesced satisfactorily until the twelfth day, when she developed hypogastric pain. This continued, although not of sufficient severity to confine the patient to bed, until six weeks after delivery, when she was seized with intense pain in the lower abdomen, accompanied by rigor. The temperature was 103.6° F., and the pulse 130. The abdomen was distended and tender. Examination revealed an enlarged and sensitive uterus. On section, the condition was seen to be due to the rupture of an intramural uterine abscess that was situated on the posterior uterine wall, one inch below the fundus. The appendages were normal. The patient made a good recovery. This case was of gonorrheal origin. In 1910 Sampson<sup>2</sup> reviewed the histories of 4 cases occurring in his practice, all of which followed parturition. None of these was due to gonorrhea. Ferguson<sup>3</sup> briefly records the history of a case of pelvic inflammatory disease occurring in the puerperium, in which numerous small intramural abscesses were present. A large pyosalpinx was associated with the condition. Recovery followed a hysterectomy. The type of infection is not mentioned. Barrows<sup>4</sup> reports 7 cases, only 1 of which was of gonorrheal origin. The reports of both Sampson and Barrows are most valuable, and cover the etiology and other important points of their cases thoroughly. From these reports it will be seen that of 11 carefully studied cases of intramural uterine abscesses, but 1 was of gonococcal origin. If we add to this series the case reported by Lea, we find 2, or 16.66 per cent., of all cases due to this type of infection. Barrows and Sampson are of the opinion that intramural abscesses of the uterus are more frequent than is generally supposed, and that the condition is seldom diagnosed before operation. The former observer believes that many accumulations of pus within the uterine wall are discharged into the uterine cavity, resulting in the recovery of the patient, without definite knowledge, on the part of the

<sup>1</sup> Lea: *Jour. Obstet. and Gyn., Brit. Empire*, 1904, vol. v, No. 2, p. 159.

<sup>2</sup> Sampson: *Amer. Jour. Obstet.*, March, 1910.

<sup>3</sup> Ferguson, J. H.: *Trans. Edin. Obst. Soc.*, 1905-06, vol. xxxi, p. 131.

<sup>4</sup> Barrows: *Amer. Jour. Obstet.*, April, 1911, p. 575.

medical attendant, of the presence of the abscess. Sudden gushes of pus from the uterine cavity, followed by relief of symptoms, have not uncommonly been attributed to the discharge into the uterus of the contents of a pyosalpinx. Barrows believes that many of these cases are in reality abscesses of the uterus. Again, pus inclosed in a shallow pocket beneath the mucosa may easily be evacuated by the curet, which has been brought into use because of the symptoms pointing to a serious inflammation of the endometrium; or the pus may burrow between the layers of the broad ligament, and, following the round ligament, present in the neighborhood of the inguinal ring, which, being opened and drained, would result in cure of the patient under a mistaken diagnosis. Purulent collections in the posterior uterine wall and low down, or even in the anterior wall, may be opened and drained under the belief that they are ordinary pelvic abscesses.

Sampson<sup>1</sup> divides intramural uterine abscesses into two groups: The first, in which the uterine abscess or abscesses are the chief feature of the infection. In this class of cases the condition exists as a distinct clinical entity. The second group consists of those cases in which the uterine condition is secondary in pathologic and clinical importance to other lesions resulting from the infection.

**Symptoms.**—Intramural uterine abscesses of gonorrheal origin may be either single or multiple, the former being the more common. They may be situated either in the cervix or in the body of the uterus, but are apparently more frequent in the latter location and often single or few in number. They may be subperitoneal, interstitial, or submucous in type, or, as previously indicated, may extend outward between the layers of the broad ligament or between the uterus and bladder. Mercade<sup>2</sup> has emphasized their frequency near the uterine cornua. The abscesses vary in size, the largest one of which an accurate description can be found having had about the volume of an orange. The condition, like acute metritis without abscess formation, is frequently preceded by labor, miscarriage, or abortion. Inquiry will usually elicit the presence of symptoms of gonorrhea of the endometrium and of the lower genital tract. Pain is present over the lower abdomen, but this is not invariably a marked feature. The temperature and pulse are elevated, and the blood examination is indicative of suppuration. The other symptoms of metritis previously described are present. Amenorrhea or irregular and profuse menstruation may be observed. All the symptoms are intensified at the menstrual periods. Examination of such a case reveals tenderness

<sup>1</sup> Sampson, C.: *Amer. Jour. Obstet.*, March, 1910.

<sup>2</sup> Mercade: *Annal. de Gyn. et d'obstet.*, 1907, second series, vol. iv, p. 29.

over the lower abdomen; the uterus is enlarged, and, if the case is one of puerperal origin, involution is delayed. On palpation the uterus will be found to be soft, boggy, and sensitive to pressure. It may in some cases be possible to palpate a softened swelling, originating in the uterus, in which fluctuation can be detected. That the appendages are not necessarily involved is proved by the cases of Lea<sup>1</sup> and Barrows.<sup>2</sup> The cervix and lower genital tract usually exhibit evidences of gonorrhea.

**Diagnosis.**—Intramural uterine abscesses are difficult to diagnose, and may be mistaken for a number of other pathologic conditions. Ordinary pelvic inflammatory disease with extensive involvement of the appendages may produce lesions that render differentiation from this condition impossible. If the appendages are normal, the diagnosis is facilitated, as in this case the normal ovaries may be palpated. Uterine abscesses must also be distinguished from uterine myomata, and particularly from softened and degenerated tumors. The anamnesis will usually be of great aid in these cases, as in the case of myomata uterine hemorrhages, often extending over a number of years, and frequently associated with a thin, leukorrheal discharge, are generally present, whereas in case of intramural abscess the history frequently shows the condition to have had its origin shortly after childbirth or following a miscarriage. Furthermore, myomata are usually multiple, and evidences of infection are lacking; in the case of a single, softened myoma, however, especially if it is associated with a gonorrhea of the lower uterine tract, the differential diagnosis might easily be rendered impossible. Small ovarian tumors in which partial torsion has occurred and adhesions exist often simulate abscesses of the uterus. In many cases the probable diagnosis of this condition can be made only by exclusion. If, however, the facts are borne in mind that gonorrheal uterine abscesses are associated with gonorrhea of the lower genital tract; that they most frequently occur at or near the cornua of the uterus; that they often have their origin in the puerperium; that the infection is usually of a low grade, compared with that produced by the streptococcus, and that the abscesses are accompanied by concomitant symptoms of metritis and endometritis—a tentative diagnosis should be possible in many cases. If untreated, the result will depend largely upon the number and location of the abscesses. If situated in the cervix, rupture into the vagina may occur and be followed by spontaneous cure. Rupture into the peritoneal cavity may take place, setting up a pelvic or a general in-

<sup>1</sup> Lea: Jour. Obst. and Gyn., Brit. Emp., 1904, vol. v, No. 2, p. 159.

<sup>2</sup> Barrows: Amer. Jour. Obst., April, 1911, p. 575.

fection. The abscess may rupture into the endometrial cavity or into the bladder or intestines, especially the rectum or sigmoid flexure, or the pus may burrow between the layers of the broad ligament, finally presenting in the vagina as a pelvic abscess, or it may follow the course of the round ligament and point in the inguinal region. In rare cases the pus may become sterile and finally be absorbed. Barrows<sup>1</sup> reports a case in which a calcareous deposit was formed in an old uterine abscess and simulated a calcareous myoma.

**Treatment.**—This depends largely upon the location of the abscess. If it is so situated that the pus may be evacuated without traversing the peritoneal cavity, the abscess should be opened and drained at once. In all pelvic infections, and especially if they are of gonococcal origin, the general tendency at present is very properly toward delaying operation until the acute symptoms have passed. This is particularly true if the infection is one that has arisen during the puerperium. For this reason, if a uterine abscess is diagnosed, palliative treatment should be instituted provided it is impossible to evacuate the pus extraperitoneally. The patient should be confined to bed, the bowels regulated, and a nutritious, but easily assimilated, diet prescribed. If the case is a non-puerperal one, or if the os is firmly contracted, frequent hot vaginal irrigations, together with the application of local heat by means of turpentine stupes or large hot poultices to the abdomen, are indicated. Stimulation may in some cases be required. Ergot, owing to the fact that it causes uterine contraction, should not be administered. (For details of the palliative treatment of pelvic inflammatory disease see the chapter dealing with this condition.) The patient should be treated in a hospital and watched carefully, so that if symptoms of rupture of the abscess occur, an abdominal section can at once be performed. If the palliative treatment is successful, the operation should be delayed as long as the patient continues to improve, or until sufficient time has been allowed to elapse for the pus to become sterile. Under such circumstances the abdominal route is to be preferred to the vaginal, and should always be employed.

Two forms of operative procedure are open to choice—incision and drainage of the abscess and hysterectomy. Noble<sup>2</sup> reports that hysterectomy has been attended with a mortality of 25 per cent., whereas in 11 reported cases of incision and drainage none of the patients died. Cragin<sup>3</sup> mentions 5 cases of multiple intramural uterine

<sup>1</sup> Barrows: *Amer. Jour. Obst.*, April, 1911, p. 575.

<sup>2</sup> Noble: *Trans. Amer. Gyn. Soc.*, 1906, vol. xxxi, p. 296.

<sup>3</sup> Cragin: *Amer. Jour. Obst.*, 1906, vol. liii, p. 779.

abscesses occurring at the Sloane Maternity, upon whom hysterectomy was performed. The mortality was 60 per cent. Harrow<sup>1</sup> also briefly reports a case of multiple abscess of the uterus caused by the streptococcus cured by hysterectomy. Vineberg<sup>2</sup> mentions two cases during the course of a discussion on puerperal thrombophlebitis in which the uterus was studded with abscesses, varying in size from a pea to a walnut. Davis<sup>3</sup> records the history of a case in which an intramural abscess occurred in a patient on whom a cesarean section had been performed. The woman, having been discharged from the hospital on the fifteenth day, returned on the twenty-ninth day and died ten days later. The location, size of the abscess, and variety of infection are not mentioned. Robins<sup>4</sup> has reported a case that occurred in a patient twenty-seven years of age, two weeks after childbirth; until this time the puerperium had been normal. The symptoms consisted of pain in the lower part of the abdomen, in the right side, and other evidences of infection. Supravaginal hysterectomy showed a single abscess in the posterior uterine wall near the fundus, which contained about 2 ounces of thick, creamy pus. The etiology of the lesion is not mentioned in the report, but the fact that the tubes were found to be normal and the ovaries were adherent is against the gonococcal origin of the condition. Harrigan<sup>5</sup> has reported the history of a case in which the patient had given birth to a child four days prior to her admission to the hospital. She suffered from cough and the usual symptoms of infection of the lower abdomen. At operation a large mass was found, consisting of uterus and adherent sigmoid. A large abscess was found on the posterior uterine wall, which had ruptured into the parametritic tissues. Hysterectomy was followed by recovery. The type of infection is not stated.

Barrows<sup>6</sup> favors drainage of these cases, and is particularly careful not to break up adhesions for fear of opening up avenues of infection. To effect drainage, he employs a large rubber tube, from  $1\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter. This tube is carried well into the abscess cavity, and held in position by an ingenious suture that passes through the abscess wall and rubber tube and is tied outside the wound. This suture keeps the tube in place, and yet may be loosened at any time without causing pain or discomfort to the patient.

The choice of the operation is dependent upon a number of factors,

<sup>1</sup> Harrow, J. A.: Bull. Lying-In Hosp., New York, March, 1911, p. 172.

<sup>2</sup> Vineberg, H. M.: Jour. Amer. Med. Assoc., July 20, 1912, p. 164.

<sup>3</sup> Davis, A. B.: Amer. Jour. Obst., December, 1912, p. 940.

<sup>4</sup> Robins, C. R.: Old Dominion Med. and Surg. Jour., 1911, vol. xiii, p. 277.

<sup>5</sup> Harrigan, A. H.: Amer. Jour. Obstet., September, 1912, p. 468.

<sup>6</sup> Barrows: *Loc. cit.*

which are generally similar to those that govern the operator in making his decision in cases of ordinary pelvic inflammatory disease. The type of infection is important in determining this point. If the abscess is single, large, walled off, and is so situated that drainage can be satisfactorily established, this operation is the safer one to perform. If, however, the appendages are extensively involved, hysterectomy offers the best hope of securing an entire symptomatic cure. In operating on these cases special care should be taken to avoid contamination of the peritoneal cavity.

The following is the history of a case that was operated upon in the Gynecological Department of the University of Pennsylvania Hospital:

*Path. No. 4108.*—Age, twenty-five years. Shortly after marriage, four years ago, a profuse purulent leukorrhea and symptoms of urethritis appeared, followed later by a labial abscess. One child three years ago. The puerperium was complicated by pelvic peritonitis. Since then sterility and occasional attacks of pelvic peritonitis. For the last year has had a cough, which has not yielded to treatment, and a slight loss of weight. Examination on admittance to the hospital showed a small tuberculous lesion in the left apex and a moderately massive pelvic inflammatory disease. It was the latter condition that brought the patient to the hospital. Diplococci, morphologically and tinctorially similar to gonococci, were demonstrated in the secretions from the cervix and from one of Bartholin's glands. A supravaginal hysterectomy and a bilateral salpingo-oophorectomy were performed. Convalescence was somewhat prolonged, but otherwise normal. The pathologic examination of the uterus and appendages showed them to have the usual appearance of pelvic inflammatory disease. The tubes were converted into pyosalpinges. The abdominal ostia were closed, and no fimbriae could be distinguished, nor were there any tubercles present upon the peritoneal surface. One ovary was the seat of a small abscess, evidently the result of an infection of a corpus luteum; the other was enlarged, covered with adhesions, and contained a number of retention cysts. The uterus was normal in size, and in the left cornua, somewhat anterior to the median line, was a semifluctuant swelling, 2.5 by 2 by 1.5 cm. Histologic examination showed this to be an intramural abscess, not communicating with the tube. No gonococci could be demonstrated in the appendages or in the intramural abscess. Numerous tubercles, many of which contained typical giant-cells, were present. This case appears to have been one in which tuberculosis was implanted upon a preëxisting gonococcal infection. Whether the intramural abscess was the result of tuberculosis or of gonorrhea it is impossible positively to determine.



## CHAPTER XII

### GONORRHEA OF THE FALLOPIAN TUBES AND OVARIES

GONORRHEA of the endometrium may, and frequently does, extend to the tubes, and from these to the ovaries. Gonorrheal infection has been observed to reach the tubes in less than two weeks after the initial contamination of the cervix. This, however, is unusual; as a rule, a much longer time elapses before involvement of these structures takes place. The relative frequency with which the appendages are invaded in comparison with gonorrhea of the endometrium is difficult to estimate accurately, but it seems likely that if the mucosa of the body of the uterus becomes infected, in the majority of cases, at least, the disease extends to the tubes, and from the latter to the ovaries. Menge,<sup>1</sup> in combining the statistics of Bumm, Stein-schneider, Fabry, Brünschke, Bröse, and Welander, found that the tubes, ovaries, and pelvic peritoneum were involved in 25 per cent. of the acute and in 50 per cent. of the chronic cases. As Bumm<sup>2</sup> has amply proved, and as previously stated in this work, the gonococcus is chiefly a surface microorganism, so that the first lesion produced in the tube by this type of infection is a catarrhal inflammation. The inflammation, however, quickly spreads from the superficial portions to the deeper layers of the tube, so that in advanced cases the muscularis and serosa are extensively involved. Wertheim<sup>3</sup> and others have repeatedly demonstrated the presence of gonococci in the depths of the tubal wall. A moderate amount of cellulitis is usually present as an accompaniment of advanced tubal disease. Gonorrhea travels by continuity along the mucous membrane. Rare exceptions to this are occasionally noted, as sometimes in cases of extensive cellulitis or in gonorrheal endocarditis and other metastatic gonorrheas. As a result of the salpingitis an inflammatory exudate forms, which, when it escapes from the abdominal ostium, produces at first a peri-oöphoritis and localized peritonitis. This may increase in gravity until an oöphoritis or even an ovarian abscess results. The same cause brings about a more or less extensive pelvic peritonitis, which is usually most marked in those areas immediately surrounding the tubal open-

<sup>1</sup> Menge, F.: *Handb. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>2</sup> Bumm, E.: *Therap. d. Gegenwart*, 1909, No. 1, p. 51.

<sup>3</sup> Wertheim, E.: *Centralbl. f. Gyn.*, 1896, No. 48, p. 1209.



ings. Adhesions of the tubes, ovaries, uterus, and adjacent structures are thus produced. In many cases the abdominal ostia of the tubes become closed, and the tubal contents are thus walled off from the peritoneal cavity. Nevertheless, during subsequent exacerbations of the pelvic inflammatory disease more pus or exudate from the tubes frequently leaks out through the tubal openings, and toxins, or even gonococci, escape through the walls of the oviducts, so that in advanced cases the entire contents of the pelvis may be found matted together in a mass of dense adhesions. Owing to the increased weight of the tubes during the early stages of the inflammation, these organs sink deeper into the pelvis and are not infrequently found adherent to the posterior surface of the broad ligament, to the rectum, or in Douglas' culdesac. In advanced cases of pelvic inflammatory disease accumulations of pus may be found between the adnexa and the adjacent structures, and walled off from the general peritoneal cavity by adhesions. Both appendages are generally involved, although not infrequently infection on one side may antedate that on the other. It is not usual, however, to find a large inflammatory mass composed of a pyosalpinx and an inflamed ovary on one side, whereas on the other little more than a perisalpingitis will be found.

The number of previous attacks of acute pelvic peritonitis are of importance in this connection. After a patient has had a number of attacks it is rare to find a normal tube on either side; so, also, if a pyosalpinx has been present on one side, it is rather unusual for the opposite tube to be entirely normal. No hard and fast rule can, however, be formulated regarding this point.

Pelvic inflammatory disease may be produced by germs other than the gonococcus, although this organism is the most frequent causative agent. The etiology of pelvic inflammations is of the utmost importance, as the prognosis varies quite widely in the different types of infection. If it were possible for the surgeon, before commencing his operation, to know positively what form of infection he was dealing with, a great advantage would be gained. Unfortunately, this is not practicable in all cases, for occasionally rare microorganisms, such as some of the air bacilli, or mixed infections will defy all diagnostic means except the incubator, and this is, of course, not available until the abdomen has been opened and is, therefore, valueless as a surgical guide. Nevertheless, the great majority of pelvic infections may be classed under three headings: the gonococcal, the pyogenic (streptococcus or staphylococcus), and the tuberculous. The differentiation between these varieties is not usually difficult. The relative frequency with which the gonococcus is found will be shown

by the following statistics: Andrews<sup>1</sup> reports, in the order of their frequency, the following microorganisms: Gonococcus, 43 per cent.; pyogenic (streptococcus and staphylococcus), 24 per cent.; colon bacillus, 5 per cent.; pneumococcus, 4 per cent.; tubercle bacillus, 1 per cent. to 3 per cent. Menge<sup>2</sup> records the results obtained from cultures of pus from 106 cases of pyosalpinx: Sterile, 68, or 64 per cent.; gonorrheal, 22, or 21 per cent.; tuberculous, 9, or 8 per cent.; streptococcal, 4, or 4 per cent.; staphylococcal, 1, or 0.96 per cent.; anaërobic bacilli, 2, or 3 per cent. Krönig<sup>3</sup> reports the bacteriologic examinations of 122 cases of suppurating tubes as follows: Sterile, 75, or 61 per cent.; gonococcal, 28, or 23 per cent.; tuberculous, 8, or 7 per cent.; pyogenic, 4, or 3 per cent.; other forms, 7, or 6 per cent. Miller<sup>4</sup> examined pus from 43 cases of pyosalpinx, ovarian abscess, and other inflammatory adnexal lesions, and found 33 sterile, 7 gonococcal, 1 pyogenic, and 2 unidentified forms of microorganisms. Hyde,<sup>5</sup> in an examination of 2973 cases, excluding those of tuberculous origin, reported the tubal contents sterile in 1998 cases, or 67 per cent. The gonococcus was recovered in 579 cases, or 19 per cent., whereas other or mixed infections were present in 456 cases, or 15 per cent. Noeggerath and Wertheim<sup>6</sup> examined 312 cases, with the following results, excluding all tubercular specimens: Sterile, 122, or 39 per cent. of cases; gonococci were found in 56 cases, or 18 per cent.; streptococci, in 11 cases, or 4 per cent.; staphylococci, in 6 cases, or 2 per cent.

Pankow<sup>7</sup> has reported that statistics computed from the University Clinic of Freiberg, these show 43 per cent. of suppurating tubal lesions due to gonorrhea, 22 per cent. to tuberculosis, and 22 per cent. to secondary infection from the appendix. Schridde,<sup>8</sup> however, has not seen a single case due to appendicitis out of 280 under his personal observation. Heyneman,<sup>9</sup> from an analysis of 47 cases, showed that 58.8 per cent. were due to the gonococcus, 23.5 per cent. to the streptococcus, 11.7 per cent. to the tubercle bacillus, and 5.8 per cent. to the staphylococcus. Lock,<sup>10</sup> in 22 cases, found gonococci in 3; 10 were sterile, and

<sup>1</sup> Andrews: Quoted by Gilmore, J. R.: Amer. Jour. Obstet., April, 1910, p. 596.

<sup>2</sup> Menge: Centralbl. f. Gyn., 1895, vol. xix, p. 799.

<sup>3</sup> Krönig, Menge and: Bact. d. weibl. Genitalkanals, Leipzig, 1897, pt. I, p. 261.

<sup>4</sup> Miller: Quoted by Crossen: Trans. Amer. Gyn. Soc., Philadelphia, 1909, vol. xxxiv, p. 662.

<sup>5</sup> Hyde, C. R.: Amer. Jour. Obstet., 1908, vol. lvii, p. 496.

<sup>6</sup> Noeggerath and Wertheim: Quoted by Crossen: Trans. Amer. Gyn. Soc., 1909, vol. xxxiv, p. 662.

<sup>7</sup> Pankow: Quoted by de Bovis: La Semaine Médicale, September 4, 1912.

<sup>8</sup> Schridde: Quoted by de Bovis: *Loc. cit.*

<sup>9</sup> Heyneman: Zeit. f. Geb. u. Gyn., 1912.

<sup>10</sup> Lock, N. F.: Jour. Obst. and Gyn., Brit. Emp., July, 1912, p. 1.

in the remainder 10 different organisms were demonstrated. An analysis of the foregoing statistics shows that of 3501 cases, the gonococcus was demonstrated in the lesions 718 times, or 17.4 per cent. A percentage of 17.4 does not, however, by any means represent the actual proportion of those cases which were of gonorrheal origin; for, apart from the well-known difficulty of demonstrating the gonococcus by either culture or staining methods in chronic cases, it is a well-established fact, and one of great clinical importance, that long encapsulation tends to destroy the gonococcus, perhaps by its own toxins.

Gurd,<sup>1</sup> after a careful study of 20 cases of salpingitis, states that he believes the gonococcus to be the exciting factor in the production of the affection in at least 80 per cent. of his series. He further adds that the reason many bacteriologic tests for this organism are negative is that the material for examination is obtained from the free pus in the abscess cavity. If the material is removed by curetage from the wall of the abscess, there is a much greater likelihood of obtaining positive results, as the gonococci persist in a virulent state in such areas long after those in the free fluid become attenuated or are totally destroyed. It is well recognized that gonococci can be demonstrated in the tubes in only a small proportion of chronic cases of salpingitis, even by the most painstaking and thorough bacteriologic examination. This must be considered in analyzing the foregoing figures. Furthermore, in many cases the gonococcus appears to prepare the soil for subsequent infection by other microorganisms, so that even in cases in which other organisms are demonstrated, gonococci may have caused the primary lesions. A careful study of the history of each case, together with a thorough examination of the cervix, urethra, and vulvovaginal glands, would throw light upon this point.

Guthrie collected statistics from 15 surgeons in Iowa, and found that 70 per cent. of all cases of pelvic inflammatory disease were of gonococcal origin. Price claims that 90 per cent. of all pelvic infections are of gonococcal origin. Norris places the proportion at 80 per cent.; Pozzi and Frederic, at 75 per cent.; Clark, at 50 per cent.; Heynemann,<sup>2</sup> at 66 per cent.; Robb, at 25 per cent.; Davis and Noble, at 5 to 10 per cent. The diversity of results obtained can doubtless be largely accounted for by considering the material from which the statistics were compiled, for, as is well known, some clinics operate on large numbers of pelvic inflammatory cases, whereas in others they will but comparatively rarely be observed.

<sup>1</sup> Gurd, F. B.: *Jour. Med. Research*, 1910, vol. xliii; new series, vol. xviii, pp. 151-175.

<sup>2</sup> Heynemann: *Zeit. f. Geb. u. Gyn.*, 1912, vol. lxx, No. 3.

The great importance of accurate diagnosis in respect to the microorganism producing the lesion is shown by a study of the behavior of the various organisms within the Fallopian tubes. A large proportion of gonorrheal adnexal lesions ultimately become sterile. The gonococcus doubtless constitutes primarily the infective type of microorganism in many of those cases in which no growth upon culture-media can be obtained. The time required to effect death or successful attenuation of the gonococcus within the Fallopian tube is from one and one-half to three months, although in exceptional cases the microorganisms may survive a longer period, as shown by Neisser,<sup>1</sup> who examined 143 cases of gonorrheal pelvic inflammatory disease, all of which had remained latent for a period of at least two months and some for as long as eight years. In 8 cases of this series gonococci were found. It is probable that in most of these 8 cases the virulence was greatly attenuated. If both ends of the tube are entirely occluded and the tubal walls are thick, the death of the infecting microorganism occurs more rapidly than if a more or less constant leakage of the tubal contents is taking place. The pyogenic microorganisms are much more erratic than the gonococci, and frequently become encapsulated, not losing their virulence for prolonged periods. Thus Miller<sup>2</sup> reports two cases, in one of which streptococci existed for six years, and in another, for twelve years; Martin<sup>3</sup> mentions a case of nineteen years' duration. In not a few cases of pelvic inflammatory disease mixed infections are present, as was proved by Hyde's<sup>4</sup> statistics. Aside from the direct influence of the specific microorganism, inflammation of the uterine adnexa may result from the action of toxins, although exactly to what extent this occurs has not yet been definitely determined. Wertheim<sup>5</sup> was the first to demonstrate the presence of gonococci in pure culture in salpingitis and also in circumscribed pelvic peritonitis.

#### ACUTE PELVIC INFLAMMATORY DISEASE

**Symptoms.**—These vary according to the extent of the lesion and the stage of the disease. Thus, when a pyosalpinx is walled off by adhesions it probably will not cause so much disturbance as a much milder inflammatory process of a tube the abdominal ostium of which is patulous and leaking.

<sup>1</sup> Neisser: Quoted by Crossen: *Trans. Amer. Gyn. Soc.*, 1909, vol. xxxiv, p. 662.

<sup>2</sup> Miller: Quoted by Kelly: *Operative Gynecology*, 1899, vol. ii, p. 211.

<sup>3</sup> Martin, F. H.: *Surg., Gyn., and Obstet.*, April, 1907, p. 501.

<sup>4</sup> Hyde: *Amer. Jour. Obst.*, 1908, vol. lvii, p. 496.

<sup>5</sup> Wertheim: *Arch. f. Gyn.*, Berlin, vol. xlii, p. 1.

The extension of the infection from the uterus to the Fallopian tube usually follows a menstrual period, or the emptying of a gravid uterus. When there is a latent gonorrheal infection of the endometrium, the disease is often spread to the tubes by some intra-uterine manipulation, performed for the relief of dysmenorrhea or sterility. The subjective symptoms are similar to those of metritis, except that when the tubes are involved the pain and tenderness are more diffuse and are not, as in the former, confined to the region of the uterus, but extend over the affected area. Furthermore, owing to the more extensive involvement of various organs, the symptoms are likely to be more severe. Bumm<sup>1</sup> and Menge<sup>2</sup> rightly lay especial stress on the question of pain as a diagnostic feature, and believe that this is always much more severe when the disease extends to the tubes than when it is confined to the uterus. In the latter case pain is often a marked symptom only at the menstrual periods.

The symptomatology of salpingitis and its accompanying inflammation is defined only with extreme difficulty, owing to the numerous structures that may be involved. The initial symptom indicative of an involvement of the Fallopian tubes is frequently a chill, followed by nausea, vomiting, malaise, headache, elevation of the temperature, and increased pulse. In gonococcal cases the temperature rarely rises above 103.5° F. or the pulse-rate above 130, and more frequently both fall below these figures. A blood-count shows an increase in the number of leukocytes. The appetite is lost, and the usual symptoms of fever are present. Rectal or vesical tenesmus may be marked if the inflamed appendages are adherent to or press against either the rectum or the bladder. Rectal tenesmus is a frequent condition. The disease may be unilateral or bilateral; in some cases both tubes are infected simultaneously, whereas in others only one side is attacked. As the inflammation spreads by direct extension from the endometrium, infection may occur at any time while the endometritis persists. The severity and duration of the attacks vary quite widely in different cases. The local symptoms are only a moderately reliable indicator as to the extent of the disease. Not infrequently, in severe cases, owing to the wide-spread abdominal tenderness, pain, and tympanites, a clinical picture suggestive of general, rather than pelvic, peritonitis will be presented. Vaginal examination at this time will reveal evidences of gonorrhea in the lower genital tract. The uterus will be found enlarged, softened, and tender. Induration will usually be present in one or both vaginal

<sup>1</sup> Bumm: *Therap. d. Gegenwart*, 1909, No. 1, p. 51.

<sup>2</sup> Menge, K.: *Handbuch d. Geschlechtskrankheiten*, Vienna, 1910.

formices. The cervix will be more or less fixed, and attempts to move it will cause pain, not only in the uterus, but in the ovarian regions as well. An inflammatory mass, varying, according to the extent and character of the lesion, from a slight thickening, induration, or indistinct sense of resistance to a tumor the size of a grape-fruit or larger, will be found occupying the region of the appendages.

During the acute stage, owing to tenderness and tympanites, it is often impossible accurately to outline the adnexal lesions. Menstrual disturbances are often present, but these are probably due largely to the accompanying endometritis and metritis. Ovarian involvement also influences the bleeding. The tubal contents at this stage contain numerous typical gonococci. The duration of the acute attack varies from a few days to two or three weeks. Unless complications arise, the disease rarely, if ever, ends fatally, but usually gradually subsides and merges into the chronic state.

#### CHRONIC PELVIC INFLAMMATORY DISEASE

The chronic stage of pelvic inflammatory disease can almost invariably be traced to an acute attack, but occasionally, in mild cases, the disease is subacute and follows an almost chronic course from the beginning. The symptoms vary according to the extent and character of involvement of the pelvic structures. In mild cases, during this stage, the subjective symptoms may be almost entirely absent, or consist at most only of discomfort at the menstrual periods. More commonly, however, the disease, for the first year or two, is progressive. Exacerbations from the chronic stage, occurring at irregular intervals, caused by leakage of the tubal contents, may occur at any time, but are more prone to occur at a menstrual period, after emptying of a pregnant uterus, during the puerperium, following trauma, such as intra-uterine manipulations or treatment, or even after excessive or violent sexual intercourse. In this way extensive pelvic pathologic changes may be produced that practically render the patient an invalid.

Menorrhagia and metrorrhagia are often present, together with the symptoms of cervical gonorrhea. In exceptional cases amenorrhea or scanty menstruation may be observed. Although no definite rule can be formulated regarding this point, it is probable that changes in menstruation bear a more or less direct relation to the amount of ovarian involvement. Boldt<sup>1</sup> states that if the tubal disease does not cause pathologic changes in the ovaries, the menstrual type is not likely to be changed. In those cases of hydrops tubæ profluens there may be an occasional noticeable discharge of the tubal contents through the

<sup>1</sup> Boldt, H. J.: Jour. Amer. Med. Assoc., July 13, 1912, p. 101.



vagina, followed by temporary relief of symptoms and a subsidence of the tubal enlargement. Pain in the lower abdomen is generally present, and is usually most marked on that side in which the lesions are most severe. In some cases, owing to the involvement of adjacent sensory nerves, pain is referred to the thighs or external genitalia. Owing to the presence of numerous adhesions, distress is often caused by the peristaltic movements of the intestines—the so-called “gas pains,” the pain being colicky in character. It is possible that in some instances colicky pain may be caused by contractions of the tubal walls. The amount of pain present is not always an indication of the extent of the inflammation, as in some very serious cases the patients suffer only a slight discomfort, whereas in others exhibiting but a comparatively mild lesion marked subjective symptoms occur. Indeed, the general excellent physical condition and small amount of disability are most remarkable in some cases. They are, however, the exceptions.

The character of the pain may also vary widely in different cases. In some it may be acute and agonizing, whereas in other patients there may be merely a sensation of weight and dragging in the pelvis. As a rule, rest in bed or the application of heat to the lower abdomen alleviates the pain. Defecation is often painful, especially in those cases in which the appendages are adherent to the rectum. As a result, constipation is often a marked feature. It is caused not only by actual pressure on the rectum, but is often due to the fact that, because of pain, the act is delayed as long as possible, and a costive habit results. This accumulation of hard feces within the pelvis tends in time to augment the pelvic inflammation, and in this manner a vicious circle is established. In some patients the symptoms resulting from the sluggish action of the bowels constitute in themselves a marked feature of the case. If the tube and ovary lie anterior and are adherent to the bladder, vesical symptoms, such as frequent and painful micturition, are more or less pronounced. Unless a pelvic examination is made, the condition may be mistaken for cystitis, while distention of the bladder or the emptying of a distended bladder may cause pain. Pain in the lower lumbar and sacral region is often present, and in some cases is most severe. Frontal or occipital headache may be a more or less marked symptom. During the chronic stage the pulse and temperature are usually normal, for during this period the exudates are confined by adhesions. For the same reason the blood examination is, as a rule, negative, or shows only a slight leukocytosis. All the symptoms are usually ameliorated, and the patient generally feels more comfortable early in the morning than after she has been about for some time. The discomfort is increased by exercise or by



the pressure of tight clothing about the waist or lower abdomen. As a rule, the more chronic in nature the disease is, the more rarely is pain a prominent symptom. The symptoms are usually more pronounced for a few days prior to and during the menstrual periods. When the menopause has become established, the suffering is frequently alleviated or disappears entirely. Dysmenorrhea is almost always present, and may in some cases be the chief subjective symptom.

Although the character of the dysmenorrhea may vary, it is usually of the congestive type. It generally begins from twelve to forty-eight hours before the appearance of the menstrual flow, and becomes less severe after the second or third day. The pain is of a dull, heavy, aching character, and occurs in the lower part of the abdomen, and is frequently worse on that side upon which the lesions are most severe. Backache in the sacral and lower lumbar regions is often present. During the dysmenorrhea tenderness is increased over the diseased areas. At the menstrual periods pain and tenderness in the inguinal regions are frequently complained of. Dyspareunia of varying severity usually exists, and if the tubes are not patulous, absolute sterility is the result. As a rule, the fimbriated extremity of the tube becomes occluded early during the course of the inflammatory process. So long as the uterine end of the oviduct remains patulous and infective material escapes through the uterine cavity, the symptoms of an endometritis will persist.

The vermiform appendix is involved secondarily in a large proportion of cases of pelvic inflammatory disease, especially when the right adnexus is affected, the condition usually taking the form of a peri-appendicitis. As a result, tenderness over McBurney's point is often observed. Exacerbations from the chronic stage are frequent, especially during the first year or two of the disease. These often follow trauma, or may result from no assignable cause. The recurrent attacks of pelvic peritonitis are caused by a leakage from the tube of infective material, which sets up local peritonitis. The leakage may occur from the abdominal ends of the tube, or irritation of the adjacent peritoneum may result from toxins or even actual gonococci passing through the tubal wall.

Constitutional symptoms vary widely, according to the individual case. The patient is usually more or less incapacitated and tires easily. At times loss of weight, anemia, and general ill health are present, although in other cases, apart from the pelvic symptoms, the patient may appear to be robust and well. Tenderness over the lower abdomen is often marked, and in severe cases the gait may be almost characteristic, the patient walking slowly, stooping forward,

often inclining slightly to one side or the other, a hand being placed over the site of the pain. As a result of prolonged suffering, impaired general health and neurasthenia not infrequently result.

Abdominal palpation reveals the presence of resistance and tenderness over the affected areas, and in thin subjects, or when the lesion is massive, a tumor may at times be felt in one or both ovarian regions.

Vaginal examination reveals the evidence of gonorrhea in the lower genital tract. Induration and tenderness are often present in one or both vaginal fornices. The cervix is somewhat fixed, and attempts to draw it down or move it in any direction cause pain in the ovarian regions and the broad ligaments. The uterus is frequently in retro-position and adherent, and may be somewhat enlarged. The tube and ovary are often bound together in an indistinguishable, adherent, tender, inflammatory mass, over which, in cases of large accumulations of fluid, fluctuation may be elicited. This is more likely to be noticeable in thin patients and in those in whom the tubal walls are attenuated. More often fluctuation is absent, and the tumor has a hard, elastic feel. Occasionally the ovary can be palpated as a separate structure, but frequently this is not practicable, and in some cases the appendages of the two sides cannot be differentiated. The inflamed masses may be bilateral or unilateral, one side usually being more extensively involved than the other. The longer the disease has persisted, and the more numerous the acute exacerbations have been, the more likely is the condition to be bilateral. In long-standing chronic cases, therefore, bilateral salpingitis is usually present. The differentiation between a pyosalpinx, a hydrosalpinx, and a hematosalpinx is in many cases impossible. In purulent cases a slight elevation of temperature, perhaps of a half or one degree, is significant. On palpation a pyosalpinx frequently imparts a hard or doughy sensation to the examining finger, whereas serous tubal accumulations are more elastic and often less adherent. Inflammatory hydrohematosalpinges give the same general sensation on palpation as do simple serous accumulations. The rare cases of hematosalpinx not due to tubal pregnancy impart a soft, doughy feel to the examining finger. The typical retort shape often assumed by non-purulent tubal accumulations sometimes acts as a guide in ascertaining the variety of lesion present.

Occasionally the tubes are small and soft, and in these cases the demonstration of salpingitis by means of palpation is extremely difficult and may be impossible without the administration of an anesthetic. Fixation of the ovary is always significant. It is in these cases especially that the history will be of great assistance in formulat-

ing a correct diagnosis. The age and social position of the patient are of importance, for although pelvic inflammation may be present in virgins, its pathogenesis in these cases can rarely be traced to gonorrhea; on the other hand, this type of infection is the most frequent in the married and among women of loose morals. The previous history of the case often discloses the fact that the symptoms appeared after a labor or a miscarriage that was followed by "chills and fever," or the patient may state that her trouble originated in an attack of "inflammation of the bowels." Gonorrheal salpingitis is always preceded by gonorrhea of the lower genital tract, so that a history of a purulent leukorrhea or other evidence of infection occurring shortly after marriage or after a suspicious intercourse is of especial significance. In these cases a history of good health and of an entire absence of pelvic symptoms prior to marriage is very suggestive. Sterility, either absolute or of the "one-child" variety, provided that no means to prevent conception have been employed, is a very common feature in cases of pelvic inflammation of gonorrheal origin.

A remarkable case of fecundation after bilateral pyosalpingitis has been reported by Gradl,<sup>1</sup> in which, within four months after bilateral pus-tubes had been diagnosed during a laparotomy, the patient became pregnant and subsequently went through a fairly normal labor and puerperium. Rupture of a pus-sac into the rectum had taken place during the acute stage of the salpingitis, and discharge of pus through the anus continued until the middle of pregnancy. Gradl believes that the ovum must have found its way either through one of the tubes, which healed spontaneously, or that a sinus permitted a communication between the ovary and the closely adherent tube, so that the Graafian follicle projected into the lumen of the latter.

Recurrent attacks, at irregular intervals, of pelvic peritonitis, lasting for a few days or more, the interim being characterized by comparative health, are typical of this type of infection. In many instances chronic invalidism and neurasthenic symptoms result.

**Diagnosis.**—This is usually readily made if the anamnesis of the case is considered and a careful examination is performed. Exceptional cases may, however, be encountered in which it is difficult to arrive at a positive diagnosis. The most frequent conditions with which pelvic inflammatory disease of gonorrheal origin is likely to be confounded are: Tuberculosis of the tubes and ovaries; small adherent neoplasms, especially dermoid cysts; small adherent uterine tumors, such as myomata; ectopic pregnancy, particularly in cases

<sup>1</sup> Gradl, H.: *Zent. f. Gyn.*, April 27, 1912.

of tubal rupture and suppuration; cellulitis of the broad ligament, and oöphoritis of pyogenic origin. A right-sided gonorrheal salpingitis may be mistaken for appendicitis. The differential diagnosis between gonorrheal pelvic inflammatory disease and appendicitis is not usually difficult. Tuberculosis often occurs in virgins, and is not infrequently associated with tuberculous lesions in other parts of the body. Dermoid cysts are generally unilateral, and a normal ovary may often be felt on the opposite side. These tumors are likely to occur in unmarried young women, and are especially prone to be found lying anterior to the uterus (Olshausen's sign). The history is often of great aid in excluding uterine myomata. Pelvic examination usually reveals the enlarged, nodular character of the uterus. When, however, the tumors are very small and intramural in type, and are associated, as they frequently are, with adnexal inflammatory lesions, the differential diagnosis is particularly difficult, and, unless the asymmetry of the uterus can be distinguished, mistakes may easily be made. Snegireff<sup>1</sup> states that when pain is due to an inflammatory process, it is generally of acute onset, and then gradually subsides. Inflammatory pains are accompanied by fever and other symptoms of infection, and the application of cold tends to relieve them, whereas in pain resulting from neoplasms, the converse is likely to be the case. The history in cases of ectopic pregnancy and the finding, in Douglas' pouch, of a doughy mass, having the peculiar, almost characteristic, crepitant feel produced by clotted blood, will usually be sufficient to establish the diagnosis.

The differential diagnosis before rupture is usually comparatively easy; the amenorrhea, followed by irregular bleeding, the concomitant symptoms of pregnancy, the absence of previous attacks of pelvic peritonitis, the lower temperature, and the results of the pelvic examinations are usually sufficient to establish the diagnosis of ectopic pregnancy. After rupture has occurred, the diagnosis is not always so easy; however, the history of sudden pain in the ovarian region, sometimes occurring after a slight physical effort, followed by the symptoms of internal hemorrhage, combined with the finding of free fluid in Douglas' culdesac, will clear up the diagnosis in most cases. After rupture has occurred and pelvic peritonitis has set in, the diagnosis is often extremely difficult. A careful history of the case is of great value in these cases. Oastler<sup>2</sup> has directed attention to the fact that in cases of pelvic inflammatory disease the uterus is usually in retroposition, whereas when ectopic pregnancy is present, it is not

<sup>1</sup> Snegireff, G.: *Monatsh. f. Geb. u. Gyn.*, July, 1912, vol. xxxvi, No. 1.

<sup>2</sup> Oastler, F. R.: *Amer. Jour. Obst.*, January, 1913, p. 158.

infrequently in anteposition. When the ectopic pregnancy is advanced, the uterus is usually diverted laterally away from the gestation-sac.

Pelvic inflammatory disease of pyogenic origin can sometimes not be differentiated from the gonorrheal form. In general the former is more severe and acute, and almost invariably follows the emptying of a pregnant uterus or intra-uterine manipulations. The examination of these cases usually reveals a marked cellulitis at the base of the broad ligament, whereas the tubes may be but little or not at all involved. The pyogenic infections are particularly prone to produce ovarian abscesses, while in gonorrhea suppurations of the ovary are usually small, somewhat infrequent, and do not occur, as a rule, unless the disease is far advanced. In gonococcal cases, therefore, the induration is usually at a somewhat higher level in the pelvis, and less dense than when the infection is the result of streptococci or staphylococci. In the latter condition uterine bleeding and a hard, almost board-like induration at the base of the broad ligaments are characteristic.

Appendicitis may be differentiated from gonorrheal infection by the history, the location of the pain, and by the fact that pelvic examination shows that the uterus and appendages are normal. It should be borne in mind that in chronic appendicitis exacerbations are especially likely to occur at the menstrual period, as a result of the congestion that occurs at this time. Morris<sup>1</sup> asserts that when the vermiform appendix is at fault, a hypersensitive point, one and one-half inches to the right of the umbilicus, is usually present, whereas if the disorder originates in the pelvis, a corresponding spot of tenderness on the opposite side will be present. Actinomycosis of the appendages may simulate gonorrhea so closely that only a careful histologic and bacteriologic examination will make differentiation possible. Actinomycosis is, however, a rare disease, and is generally secondary to an infection of the gastro-intestinal tract, which usually reaches the uterine appendages by perforation and direct extension. The appendages are the seat of dense connective-tissue formation, which often leads to an erroneous diagnosis of tumor. Not infrequently the actinomycotic specimens resemble tuberculous tubes. These features and the absence of gonorrhea in other portions of the genital tract should, in most cases, establish the diagnosis. The evidence of gonorrhea in the lower genital tract and the bacteriologic demonstration of the specific microorganism always furnish strong presumptive evidence in cases in which inflammatory disease is suspected.

<sup>1</sup> Morris, R. T.: *Amer. Jour. Obstet.*, 1909, vol. lx, No. 2, p. 570.

although it should be remembered that gonorrhea is a very common disease and may, therefore, be combined with other pelvic lesions. In a small proportion of cases confrontation may be of value. In some instances even the most skilful diagnosticians may be led into error. Vague symptoms, inability of the patient to give an intelligent history, the absence of proper facilities, faulty preparation for pelvic examination, and, finally, and perhaps the most frequent of all causes, atypical cases, are all conditions that militate against the formulation of a correct diagnosis.

The cases of gonorrheal pelvic inflammatory disease that are most likely to be mistaken for some of the foregoing conditions are usually the ones in which immediate operative intervention is required. Thus, torsion or rupture of inflammatory adnexa produces symptoms, especially if upon the right side, which closely simulate acute appendicitis, both of which conditions require immediate operative interference.

The greatest gentleness should always be observed when examining cases of pelvic inflammatory disease suspected to be of gonococcal origin, for rough handling may cause an acute exacerbation. The more acute the case is, the greater are the dangers arising from trauma. Indeed, a slight rise of temperature following a pelvic examination is almost characteristic of this disease, especially if the lesions are suppurative in type.

**Prognosis.**—Owing to the great variety of lesions included under the term "pelvic inflammatory disease" (metritis, salpingitis, oöphoritis, pelvic peritonitis, cellulitis, lymphangitis, and parametritis), the ultimate outcome of untreated cases varies widely in different cases. If pus is present, the abscess may rupture into the general peritoneal cavity, setting up a diffuse or a local peritonitis, or, in rare instances, even a general septicemia. The result of intraperitoneal rupture depends largely upon the virulence of the infection and the resistance of the patient. (See Chapter XIII.) The abscess may, if situated low down in Douglas' culdesac, discharge through the vagina, and leave behind a fistulous tract, or it may rupture into the intestine, especially the rectum, and produce a temporary or permanent intestinal fistula, the pus being discharged through the anus and not infrequently causing a proctitis. When the abscess ruptures into the intestine, this usually brings about a temporary cessation of symptoms, and in rare instances a cure may in this way be established. This is by no means an uncommon complication in neglected cases. Alexandre<sup>1</sup>

<sup>1</sup> Alexandre: Contribution à l'étude des pyosalpinx spontanément ouvert dans le rectum, 1911, Destout Aîné et Cie., Paris, p. 60.



has noted this condition frequently. If a proctitis results, the infection of the intestine is likely to be extremely chronic. If the abscess lies anterior to the uterus, it may burst into the bladder and its contents be passed through the urethra, thus setting up a cystitis. Cajal<sup>1</sup> and Kouchner<sup>2</sup> have reported cases of this condition. In rare instances the contents of the inflammatory adnexa may be discharged into the uterine cavity. The inflammatory appendage may rupture and discharge its contents between the layers of the broad ligament, and from here the pus may burrow downward and present in the vagina, or it may follow the course of the round ligament and point in the inguinal region. In very exceptional cases, such as those reported by Veit<sup>3</sup> and by Gaget,<sup>4</sup> pus may burrow its way through the abdominal wall and in this way produce a tubo-abdominal fistula. Rupture in any form is unusual. A pyosalpinx may be converted into a hydrosalpinx and the tubal contents, becoming sterile, may be gradually partially or entirely absorbed, and in this way the residuum of the disease may continue for years without producing severe symptoms. Menge<sup>5</sup> and others refute, on histologic grounds, the possibility of a pyosalpinx ever becoming a hydrosalpinx. That in rare instances the contents of a hydrosalpinx may become purulent is conceded by all observers.

Mild cases, especially those in which occlusion of the tube does not take place, may undergo complete resolution. Bumm<sup>6</sup> believes that so long as the infection is confined to the tubal mucosa a complete cure may result, but if the disease extends beyond this point, adhesions and other lesions follow. More commonly, however, these patients remain semi-invalids for the remainder of their lives, periods of quiescence being interspersed with acute attacks of pelvic peritonitis. Many patients become neurasthenic. The onset of the menopause is often followed by relief: the atrophy of the mucosa and musculature of the genital tract, the cessation of the monthly congestion incident to menstruation, and the ending of the sexual life of the individual all tend to lessen the disease.

<sup>1</sup> Cajal, P. R.: *La Clinica moderna*, July, 1912, pp. 363-367 and 404-408.

<sup>2</sup> Kouchner, M.: *Vratchebnaya Gazeta*, April, 1912.

<sup>3</sup> Veit: Quoted by Cumston: *Amer. Med.*, 1902, vol. iv, p. 611.

<sup>4</sup> Gaget: *Lyon méd.*, 1908, vol. exi, p. 978.

<sup>5</sup> Menge: *Cent. f. Gyn.*, 1895, vol. xix, p. 799.

<sup>6</sup> Bumm: *Therap. d. Gegenwart*, 1909, No. 1, p. 51.



## CHAPTER XIII

### THE TREATMENT OF PELVIC INFLAMMATORY DISEASE

It is now well recognized that operative intervention during the acute stage of gonorrheal pelvic inflammatory disease is unwise unless delay would endanger the life of the patient or if pus is present and can be evacuated without traversing the peritoneal cavity. Gonorrheal pelvic inflammatory disease, unlike similar conditions produced by the pyogenic microorganism, usually tends to become chronic, and the cases in which delay is dangerous to the life of the patient are exceptional. The greatest advance that has been made in recent years in the treatment of these cases is the adoption of the waiting policy advocated by Simpson.<sup>1</sup> This consists of keeping the patient in bed, the judicious use of mild laxatives, the application of either cold or heat to the lower abdomen, and the employment of frequent copious vaginal irrigations. These are the sheet-anchors of treatment during the acute stage of gonorrheal pelvic inflammatory disease. Various other methods, some of which are subsequently described, have been recommended, but the value of many of them has not as yet been positively proved. It must be remembered that most cases of pelvic inflammatory disease will survive the acute stage, even if left entirely alone. Any form of treatment that may produce trauma is not without danger, and is at least likely to prolong, rather than accelerate, the subsidence of the disease.

Hofmeister<sup>2</sup> advises against all forms of purgation, and depends solely upon enemata; as has previously been stated, enemata given during the course of an acute gonorrhea are not without danger, and, in the author's opinion, are contraindicated in the majority of cases. During the acute stage of the disease liquid diet should be prescribed, and as the acute symptoms begin to subside a light, nourishing, easily digested diet, free from alcohol, should be ordered. If, during the acute stage, any doubt exists as to the source of the peritonitis, all solid food by mouth should be withheld until this point is cleared up. In this connection it should be remembered that during the acute stage some cases of pelvic peritonitis closely simulate appendicitis, and for

<sup>1</sup> Simpson: Jour. Amer. Med. Assoc., 1909, No. 15, vol. liii, p. 1175.

<sup>2</sup> Hofmeister: Deutsch. med. Wochenschr., 1909, vol. xxxv, p. 2249.

this reason every caution should be adopted. Pelvic examinations should be as limited in number as possible, and should be gently performed, as the dangers to the patient from trauma are very great. Cold by means of ice-bags or ice-coils should be applied to the lower abdomen and frequent copious cold douches administered. Hofmeier,<sup>1</sup> Bumm,<sup>2</sup> and Freund<sup>3</sup> are strong advocates of this treatment.

As the acute symptoms begin to subside the application of heat to the lower abdomen, together with the frequent use of copious hot vaginal douches, is of great benefit. Heat may be applied in the form of hot sand-bags, the weight of the bags being regulated to suit the comfort of the individual patient; or large hot poultices, rubber coils containing hot water, or a hot-water bag may be employed. In any case the heat should be applied as constantly as possible, a temperature of 110° to 120° F. being maintained. A good working rule in this respect is to have the application as hot as can be comfortably borne by the patient. Alexandron<sup>4</sup> is strongly of the opinion that heat should be applied when absorption is desired, and that cold is preferable for purposes of stimulation. The majority of the German authorities apply cold during the acute state and heat when the symptoms become subacute or chronic, the heat frequently being applied by means of hot air, in the manner described in a previous chapter. Sieber<sup>5</sup> employs a modified hot-air apparatus that provides a constant current of varying temperatures, as demanded by the individual case. The apparatus consists of a series of tubular celluloid specula, which may be connected with an electric heating apparatus in such a manner that a current of hot air can be delivered at the end of the speculum without unduly heating the latter. A temperature of 200° C. can be generated. Sieber has used the apparatus with success in a large number of cases in which pelvic exudates were present.

Alternate hot and cold applications are recommended by Prochownick,<sup>6</sup> who advises the application, first, of ice to the abdomen, followed by moist heat, and finally hot air in the form of electric-light baths so arranged that the heat can gradually be increased. As resolution occurs the duration of the hot-air baths is lengthened. Hot vaginal douches, consisting of one and one-half gallons of sterile water or of normal salt solution, should be administered two or three

<sup>1</sup> Hofmeier: *Deutsch. med. Woch.*, 1909, No. 35, p. 2249.

<sup>2</sup> Bumm, E.: *Therap. d. Gegenw.*, 1909, No. 1, p. 51.

<sup>3</sup> Freund, H.: *Therap. Monatsh.*, March, 1911, vol. xxv, No. 3, p. 157.

<sup>4</sup> Alexandron: *Monats. f. Geb. u. Gyn.*, vol. xii, p. 466.

<sup>5</sup> Sieber: *Münch. med. Woch.*, January 30, 1912.

<sup>6</sup> Prochownick, L.: *Monats. f. Geb. u. Gyn.*, 1909, No. 29, p. 453.

times daily. In these cases small douches are of little value; indeed, Richelot<sup>1</sup> states that as much as 20 gallons should be employed. If the discharge is profuse, the douche may be preceded by an irrigation with a quart of hot water to which a dram of A. B. C. douche powder or other mild antiseptic has been added. It is important that the douche be given slowly and that no force be used. It will usually be found that the much hotter fluid may be employed if the temperature is raised gradually than if very hot water is used at the beginning. The same caution should be employed in the administration of these douches as has been described under the treatment of acute metritis. If the pain is very severe and is not relieved by the application of either heat or cold, the administration of some one of the opium derivatives may become necessary, but these should be exhibited as sparingly as possible. Schindler<sup>2</sup> contends that to account for the large proportion of gonorrheal infections above the cervix the uterus must possess some active movements, the gonococcus, as is well known, being non-motile. This observer believes these movements are involuntary and not influenced by the central nervous system. The administration of atropin paralyzes the automatic movements, and for this reason he recommends its use during the acute stage of all gonorrheal infections.

During the acute stage the placing of the patient in the upright Fowler position is of great advantage, not only for the treatment of the peritonitis, but it helps very materially in draining the uterus, which is usually the seat of an endometritis or a metritis. In cases that present unusually severe symptoms of pelvic peritonitis enteroclysis, as suggested by Murphy, may be employed with advantage. To guard against infection of the rectum the perineum and external genitalia should be thoroughly wiped with absorbent cotton soaked in 1:1000 bichlorid solution. A tampon should be inserted in the vagina before the rectal tube is introduced. Additional medicinal treatment is rarely indicated.

The advantages to be derived from the palliative treatment over immediate operative intervention are manifold. In itself, gonorrhea is rarely a fatal disease. The results of this plan of treatment are generally most satisfactory. Large, painful tubes resolve themselves into small adherent organs, the ovarian symptoms tend to subside, and tender, adherent masses finally disappear. While surgical intervention is not indicated in the great majority of cases of acute gonorrheal pelvic inflammatory disease, nevertheless the patients

<sup>1</sup> Richelot: *La Gynécologie*, May, 1909.

<sup>2</sup> Schindler, C.: *Arch. f. Gyn.*, Berlin, 1909, vol. lxxvii, p. 607.

are essentially surgical subjects and should be carefully guarded, as complications may arise that will demand immediate operation. If pus forms and can be evacuated without danger of infecting the peritoneal cavity, this should be done at once, and in these cases the incision should be a large one—at least 5 to 8 cm. in length. Boldt<sup>1</sup> recommends an incision large enough to admit the hand. With the rare exception of rupture or torsion of an inflamed uterine appendage or the development of general peritonitis, these are practically the only indications for operative intervention during the acute stage.

Kuhn<sup>2</sup> suggests the treatment of pelvic inflammatory diseases with injections of normal salt solution into the rectum. His plan differs from the Murphy-Ochsner method. Kuhn suggests that the rectum be distended at six-hour intervals with from 1 to 4 pints of the solution at a temperature of 105° F., increasing the quantity gradually as tolerance to the larger amount is established. He claims for the method that it produces hyperemia, hastens the destruction of the infecting organisms, induces absorption, prevents the formation of adhesions, stimulates the emmetories, and relieves pain. The method can hardly be recommended, at least as a routine procedure, as the discomfort caused to the patient is considerable and the dangers of infection of the rectum are great. Unless the treatment is applied with the utmost care, the danger from overdistention of the rectum and the possibility of lighting up a chronic inflammatory disease by the trauma incident to the distention, are to be feared. Flatau<sup>3</sup> recommends applying heat by means of the "pelvitherm" (Heinroth Slinger, Ulm a.D., Germany), which raises the temperature in the female pelvis to about 40° C. (104° F.). Cheron<sup>4</sup> recommends the use of radium in the treatment of chronic adnexitis and peri-adnexitis, on account of its atrophic action on the ovaries. The treatment lasts from one to six weeks. This author believes that radium therapy alone will cure many cases, and that it is an excellent preliminary to, and adjunct in, the treatment of most cases in which surgical intervention is necessary. The radium is applied in silver tubes 0.5 mm. in diameter. These are introduced into the uterine cavity under aseptic precautions. Fabre<sup>5</sup> asserts that radium gives marked relief from pain and frequently softens indurated areas of cellulitis. Com-

<sup>1</sup> Boldt, H. J.: Jour. Amer. Med. Assoc., July 13, 1912, p. 103.

<sup>2</sup> Kuhn, J. F.: Texas State Jour. Med., December, 1911, vol. vii, No. 8.

<sup>3</sup> Flatau, S.: Münch. med. Woch., 1909, No. 2.

<sup>4</sup> Cheron, H.: Rev. mens. de gyn. d'obst. et de pæd., December, 1911; also La Obstétrique, November, 1909.

<sup>5</sup> Fabre: Arch. Roentgen Rays, November, 1910, p. 228.

plete cures usually require prolonged treatment. Jacobs<sup>1</sup> and Barcat<sup>2</sup> also recommend this form of treatment in the chronic stage of pelvic inflammatory disease. The last-named author's paper contains a review of the recent literature on this subject. Menge<sup>3</sup> mentions that in the Heidelberg Gynecological Clinic old gonorrheal adnexitis cases that are complicated by profuse bleeding and discharge are treated with the x-ray. The belief of some authors that this treatment will cause an exacerbation of the infection is combated by Menge, who reports excellent results from its employment.

As the acute symptoms subside hot salt sitz-baths or hot general baths can often be given with advantage. Freund<sup>4</sup> has shown that when hot sitz-baths are given, the vaginal temperature is often raised as much as 5° to 10° F. At this stage Prochownick<sup>5</sup> and others recommend the use of the mercury colpeurynter. This is left in place at first for two or three hours daily. The period of retention is gradually increased, as is the size of the colpeurynter, and toward the latter stages of the treatment the instrument can usually be retained without discomfort overnight. A hard-rubber cylinder has sometimes been substituted for the colpeurynter. At this stage Hofmeier<sup>6</sup> applies heat by means of a thermophile. Sellheim<sup>7</sup> applies heat by means of an electric current, one electrode being placed over the lower abdomen and the other in the vagina, the pelvic temperature being raised to about 40° or 41° C. (104°–105° F). This produces first a hyperemia, then an anemia, and finally a cyanosis of the vaginal mucous membrane. This writer prefers this method of applying heat, for by its employment it is possible accurately to measure and control the heat. The author believes that the indiscriminate application of electricity to cases of pelvic inflammatory disease is not without danger, as is instanced by the case of rupture of a pyosalpinx during such treatment reported by Fisher.<sup>8</sup>

Freund<sup>9</sup> recommends congestion of the pelvic organs, as advocated by Bier,<sup>10</sup> the suction apparatus being placed over the lower abdomen. He also has the patients assume the knee-chest posture for ten minutes twice daily, having found that this treatment lowers the temperature

<sup>1</sup> Jacobs: *La Radium en Gynécologie*, 1911.

<sup>2</sup> Barcat: *Précés de radium therapie*, Paris, 1912.

<sup>3</sup> Menge, K.: *Hand. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>4</sup> Freund, H.: *Therap. Monatsh.*, March, 1911, vol. xxv, No. 3, p. 157.

<sup>5</sup> Prochownick, L.: *Monats. f. Geb. u. Gyn.*, 1909, vol. xxix, p. 453.

<sup>6</sup> Hofmeier: *Deutsch. med. Woch.*, 1909, No. 35, p. 2249.

<sup>7</sup> Sellheim: *Monats. f. Geb. u. Gyn.*, May, 1909, vol. xxxi, p. 92.

<sup>8</sup> Fisher, J. M.: *Trans. Phila. Obstet. Soc.*, 1911.

<sup>9</sup> Freund, H.: *Therap. Monatsh.*, March, 1911, vol. xxv, No. 3, p. 157.

<sup>10</sup> Bier: *Hyperämie als Heilmittel*, fifth edition, 1907.

of the vagina 4° to 7° F. and sometimes more. This position also tends to prevent the occurrence of extreme retrodisplacement of the uterus. While the patients are in bed, and after the disappearance of the fever, general massage is beneficial, but care must be taken that no trauma is inflicted on the abdomen. For this reason the massage should be administered only by a skilled and specially instructed attendant.

After about the second or third week, when the temperature and pulse are normal, it is usually advisable to get the patient out of bed and into the open air. Indeed, when possible, marked improvement is usually shown, even in bed patients, when they can be kept in the open air, and it seems probable that this adjunct to the treatment of pelvic inflammatory disease has been much neglected in the past. Stone<sup>1</sup> and Young and Williams<sup>2</sup> have strongly recommended this form of treatment. These writers state that, by this means, their mortality in severe cases of puerperal sepsis have been reduced nearly 20 per cent. They believe that sunlight is nearly as important as fresh air, and think that the open-air treatment is beneficial largely because of the fact that it quickly increases the amount of hemoglobin. Watkins<sup>3</sup> is a firm believer in this mode of treatment. The author's experience has been that patients do far better in the open air than when confined to a room or ward, no matter how well ventilated the latter may be. Van Oordt<sup>4</sup> has demonstrated, by his extensive experiments, that patients who are exposed to low temperatures, either in a nude state or scantily clothed, show a leukocytosis that is produced by thermotaxis. The leukocytosis lasts as long as the exposure to cold is continued. Lenkei<sup>5</sup> found that in his researches cold air produced a 9.8 per cent. increase of leukocytes. Orr,<sup>6</sup> however, found that in afebrile patients in whom the face only was exposed there was no constant change in the leukocytes.

The general plan of treatment should be a building-up and strengthening process. Mild laxatives and tonics containing iron or arsenic may be indicated. All exercise should be restricted, and sexual intercourse interdicted. The dangers of reinfection from a husband who has an uneured gonorrhea and of trauma incident to coitus are very real and have been extensively dwelt upon by Boldt<sup>7</sup> in a recent article.

<sup>1</sup> Stone: *Med. Record*, 1907, vol. lxxi, p. 246.

<sup>2</sup> Young, E. B., and Williams, J. T.: *Boston Med. and Surg. Jour.*, March 14, 1912, p. 405.

<sup>3</sup> Watkins, T. J.: Personal communication.

<sup>4</sup> Van Oordt: *Zeit. f. diätetische u. physikalische Therapie*, 1905-06, vol. ix, p. 338.

<sup>5</sup> Lenkei: *Pester med. Chir.*, May, 1910, vol. xlvii, No. 20.

<sup>6</sup> Orr, T. G.: *Amer. Jour. Med. Sci.*, August, 1912, p. 238.

<sup>7</sup> Boldt, H. J.: *Jour. Amer. Med. Assoc.*, July 13, 1912, p. 100.

The douches should be continued, and local treatment, consisting of the insertion of a vaginal tampon saturated with ichthyol or glycerin, or one of the other remedies recommended in the treatment of metritis, should be applied once or twice a week. The tampon should be left in place for from ten to sixteen hours, and on its withdrawal a hot vaginal irrigation should be given. On the days when the tampons are inserted all other forms of local treatment should be discontinued. If, during the course of this treatment, the temperature rises to 100° F., or other symptoms indicative of a recurrence of the acute condition appear, the patient should return to bed and the treatment previously outlined for the acute stage of the disease administered. During the course of the palliative treatment it is of the utmost importance that all local measures be applied with great gentleness, as trauma at this stage is likely to light up the acute condition.

With the palliative method of treatment a certain percentage of cases will be spared any form of operative intervention. Before entering into a discussion of the permanent efficiency of this treatment, however, it is important first to define what is meant by a cure, as a complete anatomic cure is, in the majority of cases, impossible. In this connection Prochownick<sup>1</sup> states that when a cure is permanent the patient must be able to take up her mode of life or occupation; her sexual organs and the neighboring intestines must functionate regularly and painlessly. Prochownick's statistics are of particular value; his hospital is so richly endowed that patients are allowed to remain indefinitely, and, if necessary, they are sent to the seashore at the hospital's expense. In compiling his statistics he has included no cases that have been treated later than 1905, so that it may be inferred that all recurrences have been noted. It is, of course, impossible in this connection positively to exclude all forms of infection other than gonorrheal. In Prochownick's series no tuberculous cases are admitted. He, however, includes in his list of cases receiving palliative treatment those in which pus collections in either the tubes or the ovaries were evacuated extraperitoneally, and in which no organs were removed. Of 420 cases, 160, or 38 per cent., were permanent cures. Of these, 70 per cent. were treated for not less than four weeks, whereas many were treated for five or six weeks in the hospital and were then sent to a sanatorium for three or four weeks more. Of the 160 cases, 10 per cent. had pus collections which were evacuated, and these usually required treatment for two or three weeks longer than those in which no operation was necessary. Of the 160 cases, 85, or 55 per cent., remained well after one course of treat-

<sup>1</sup> Prochownick, L.: *Monats. f. Geb. u. Gyn.*, 1909, No. 20, p. 453.



ment. Of this number 14 subsequently gave birth to children and 3 aborted. After a second course of treatment 27 remained well and 3 became pregnant, of which 1 aborted. In other words, 1 in every 8 cases cured became pregnant. In this connection it should be remembered that many of these patients were not married and that others were not young, so that if the statistics covered only those patients in which impregnation was likely to occur, the proportion would probably be much higher. Of these 160 cases 10 finally required operation for relief of adhesions, but it was not necessary, however, to remove any organs. These 10 operations occurred at varying intervals of from three to five years after the first treatment. One of these patients subsequently gave birth to a child. The number of permanent cures without any operative interference whatever was 80, or 19 per cent., of 420 cases. In Prochowniek's series of cases no deaths resulted from the palliative treatment. In contradistinction to the foregoing statistics, Henkel<sup>1</sup> states that in from 80 to 90 per cent. of all inflammatory affections of the adnexa "subjective healing" occurs following judicious non-operative treatment. Olshausen<sup>2</sup> is a firm believer in the palliative treatment, and in his clinic operations on inflamed adnexa are, if possible, deferred until nine months after the occurrence of the infection, and are then performed when the temperature is normal.

Goth<sup>3</sup> has recently reported excellent results in a series of 700 cases of pelvic inflammatory disease treated by the palliative method in Szabo's clinic. The treatment consisted in rest in bed, the application of ice-bags over the lower abdomen, and copious vaginal irrigations of cold sterile water—at a temperature of 10° or 11° C. (50° to 51° F.)—during the acute stage. As soon as the temperature and pulse became normal and the pain had subsided hot applications were substituted for the cold, and tampons containing from 10 to 20 per cent. ichthyol were introduced two or three times a week. When the presence of gonococci could be demonstrated in the discharge, protargol in 20 per cent. solution was employed in place of the ichthyol. Pelvic examinations were made once a week. Preparations of iron were employed as tonics, and morphin was given to control pain and ergotin to check bleeding. The cures consumed on an average fifty-six days, the minimum being eighteen days, and the maximum, two hundred and thirty days. Goth believes that febrile cases respond more readily than afebrile ones to treatment.

<sup>1</sup> Henkel: Quoted by Esch: *Zeit. f. Geb. u. Gyn.*, 1907, vol. lix, No. 1.

<sup>2</sup> Olshausen: Quoted by Esch: *Zeit. f. Geb. u. Gyn.*, 1907, vol. lix, No. 1.

<sup>3</sup> Goth: *Arch. f. Gyn.*, vol. xcii, No. 2, p. 300.

De Rouville<sup>1</sup> reports the results obtained in a series of 40 cases treated by the palliative treatment. Of these, 32 were cured and 3 subsequently became pregnant. Griffith<sup>2</sup> reports the results obtained by the palliative treatment in 48 cases. No deaths occurred, and the local conditions were much improved. Töpfer<sup>3</sup> strongly urges palliative treatment in these cases.

The chief difficulty attendant upon the form of treatment just outlined is the amount of time that is required. During the acute stage the patient should certainly be in a hospital. After two or three weeks the condition is generally such that the remainder of the treatment can be carried out in the home, under the supervision of the family physician. Before such patients are discharged from the hospital they should be informed of the nature and probable course of their disease, and a careful bimanual examination should be made in order to ascertain the exact pelvic condition. They should be instructed regarding their mode of life and the importance of treatment; sexual intercourse should be interdicted. Whenever possible, the entire course of treatment is best carried out in a hospital or sanatorium, for in spite of the most careful instructions, these patients, when at home, after the pain has subsided frequently commit indiscretions in diet, neglect their treatment, or indulge in sexual intercourse, oftentimes with a chronically infected husband, and as a result, relapses occur. The patient's social status is of importance in this connection. As has been pointed out by de Rouville,<sup>4</sup> women who have to work hard are more prone to develop a recurrence after palliative treatment than are their more well-to-do sisters.

The author believes that, in spite of any form of palliative treatment that may be adopted, the majority of gonococcal inflammations of the appendages will ultimately require operative intervention; nevertheless, he is of the opinion that a fair trial of such treatment should be made in each case, and that by this method better operative results will be obtained than if immediate operation were undertaken. Under the palliative treatment the infective microorganisms in many cases become innocuous, and the uterus and adnexa again approach the normal. Nature has been allowed to cure as much of the pathology as possible, and when the abdomen is opened, one can more easily decide upon the most suitable operation for the individual case. There can be no doubt that following the expectant treatment a greater

<sup>1</sup> de Rouville: *Annal. de Gyn. et d'Obst.*, October, 1910.

<sup>2</sup> Griffith, W. S. A.: *Brit. Med. Jour.*, October 26, 1912, p. 1106.

<sup>3</sup> Töpfer: *Berlin. klin. Woch.*, September 2, 1912.

<sup>4</sup> de Rouville: *Annal. de Gyn. et d'Obst.*, October, 1910.

number of cases will be rendered suitable for conservative operations than if they were at once subjected to surgical treatment during the acute stage. Furthermore, the mortality will be reduced. Following this plan Simpson<sup>1</sup> has reported 475 consecutive abdominal sections for inflammatory lesions of tubal origin, with only 4 deaths. In addition to the reduced mortality, the postoperative results will be improved. It will be found that the operation can be performed with greater speed and less anesthetic will be required, and fewer hernias and a lessened proportion of operative infections and consequent postoperative adhesions will be encountered.

By converting acute inflammatory infections of pelvic origin into aseptic lesions the mortality will be reduced and the postoperative results vastly improved. Undoubtedly, occasionally cases will be encountered that will not improve under expectant treatment, but the more carefully these cases are studied, the fewer will be the number requiring immediate operative intervention. Sanger, the skilled pathologist and gynecologist par excellence, was the first to lay stress on the fact that chronically adherent appendages were not the seat of infection, but merely the derelicts of the gonococcal storm. Accuracy of diagnosis is the necessary adjunct to this treatment, and only by its aid can the surgeon successfully adopt the waiting policy. Bumm<sup>2</sup> is of the opinion that the majority of cases of postoperative peritonitis result from too early operation. He thinks it best to wait until the infection becomes localized, as sometimes there is a mixed infection, and early operation on such cases frequently results in fatal peritonitis. Thaler,<sup>3</sup> after having reviewed 6179 cases of pelvic inflammatory disease at Schauta's clinic, concludes that operative treatment is indicated only after palliative treatment has failed, except in cases where it is necessary to evacuate pus.

Aulhorn<sup>4</sup> reports an interesting series of treatments from Zweifel's clinic. In 123 cases of adnexitis that were chiefly gonococcal in type, and that varied in degree from slight inflammations to large tubal abscesses, he injected silver solutions into the uterine cavity. Some years previously Zweifel had carried out a series of experiments which consisted of the injection of methylene-blue solution into the uterine cavity, and found that in every case the blue was carried out into the tubes.<sup>5</sup> Aulhorn's<sup>6</sup> treatment consisted of the following:

<sup>1</sup> Simpson: Jour. Amer. Med. Assoc., 1909, No. 15, vol. liii, p. 1175.

<sup>2</sup> Bumm: Therap. d. Gegenwart, 1909, No. 1, p. 51.

<sup>3</sup> Thaler, H.: Arch. f. Gyn., Berlin, vol. xciii, No. 3, p. 413.

<sup>4</sup> Aulhorn: Arch. f. Gyn., vol. xv, No. 2, p. 213.

<sup>5</sup> In 11 cases, 8 of which were inflammatory and in 3 of which the tubes were normal, the author has injected either methylene-blue or starch solution into the uterine cavity. In none has it been possible to demonstrate the material in the tubes.

<sup>6</sup> Aulhorn: *Loc. cit.*

No injections were made during the acute stage. The patients were kept in bed. The injections were made up of a colloidal silver, such as argentamin, or a silver phosphate, often ethylendiamin, in 2 per cent. solution. One or 1.5 c.c. was injected at the first treatment. At subsequent treatments this amount was increased to 2.5 c.c. The treatments were given 6 times a week. At first considerable pain followed the injections. This lasted for one or two hours. Of 123 cases, 108, or 88 per cent., were cured of all symptoms, 7 improved, whereas in 8 little or no benefit was derived. Examined objectively, a cure was effected in 89, or 72 per cent., marked improvement in 16, and little or no improvement in 18. Before treatment, 60 of these cases had palpable tubal abscesses the size of a hen's egg or larger; 46 of these were objectively cured. Cures required from 15 to 40 injections, and extended over a period of from four to six weeks. During the course of treatment many cases suffered from menorrhagia. All treatments were discontinued during menstruation. Aulhorn<sup>1</sup> has employed intra-uterine injections over 3500 times, and has never seen a case in which ill effects resulted. The author is of the opinion that this form of treatment requires more confirmatory experiments before its adoption could be generally recommended, and that it is quite probable Aulhorn's results would have been quite as good if no intra-uterine injections had been given.

#### THE TIME TO OPERATE ON CASES OF PELVIC PERITONITIS

Not infrequently cases are seen in which the question arises as to whether a hysterectomy and a bilateral salpingo-oöphorectomy shall be done and the patient relieved of her present trouble, or whether it is advisable to perform one of the conservative operations. To decide this question many factors must be taken into consideration—the age of the patient, whether she has a number of children, whether she is particularly desirous of maternity, whether she has to support herself by hard manual labor, her social status, and, lastly and almost of paramount importance, the temperament of the individual. Even after a careful study of each case and a review of all the points bearing on it it will in not a few cases be difficult to decide what course will be best for the ultimate welfare of the patient. The author believes that, when not contraindicated, a period of at least from four to six weeks should be allowed to elapse during which the temperature and the blood-count remain normal, before operation for intra-peritoneal gonorrheal pelvic lesions is undertaken; and that preliminary palliative treatment should be given to all cases before operation.

<sup>1</sup> Aulhorn: *Loc. cit.*

When possible, it is best to operate about a week or ten days after menstruation has ceased, as at this time less congestion is present and infection is probably somewhat less likely to occur. It has been amply shown, by both bacteriologic and clinical investigation, that more gonococci and other organisms, in cases of mixed infection, are present in the discharge from the genital tract at and immediately subsequent to menstruation, so that this time would seem, at least theoretically, less favorable than during the interval period. Hyde,<sup>1</sup> however, believes that work can be done on these cases as satisfactorily during menstruation as at any other time. Lovrich<sup>2</sup> states that during the menstrual congestion it is much harder to overcome hemorrhages; he, therefore, operates during menstruation only in cases where postponement is impossible.

#### CONSERVATIVE SURGERY OF THE UTERUS AND APPENDAGES IN CASES OF GONOCOCCAL PELVIC PERITONITIS

The advantages to be derived from conservative pelvic surgery are now well recognized. For many years conservative surgery of the pelvic organs was looked upon somewhat doubtfully, for a certain proportion of the cases were not subjectively cured, and in some instances required secondary operations. As has previously been pointed out, preliminary treatment greatly lessens this proportion. It is a significant fact that those who have most vigorously attacked this form of conservative surgery are the operators who have not followed the after-histories of their cases, and who base their assertions on general grounds that are not borne out by accurate data. Polk,<sup>3</sup> in this country; Pozzi,<sup>4</sup> in France; and Martin,<sup>5</sup> in Germany, were among the early advocates of conservative surgery in cases of gonorrheal pelvic inflammatory disease. Conservative surgery of the pelvic organs may be divided into operations on the tubes, ovaries, or uterus.

#### CONSERVATIVE SURGERY OF THE FALLOPIAN TUBES

In the author's opinion, this form of surgery has a very limited field. The presence of pus in the tube is an absolute indication for its removal in all cases. Small adherent tubes, in which the abdominal ostia are closed, should also be excised. The only cases in which a

<sup>1</sup> Hyde, C. R.: *Amer. Jour. Surg.*, April, 1912, p. 133.

<sup>2</sup> Lovrich, J.: *The Sixth International Congress of Obstetricians and Gynecologists*, Berlin, September 9 to 13, 1912; *Surg., Gyn. and Obst.*, December, 1912, p. 743.

<sup>3</sup> Polk, N. M.: *New York Med. Record*, September 18, 1886.

<sup>4</sup> Pozzi: *Rev. de Gyn.*, 1897, vol. i, No. 3.

<sup>5</sup> Martin, A.: *Volkman's Samml. klin. Vorträge*, 1889, No. 343.

salpingostomy is ever justifiable is in old, non-active hydrosalpinges, and in those cases of tubal occlusion or phimosis resulting from extra-tubal inflammation, such as sometimes results from appendicitis or ectopic pregnancies. The latter cases are obviously rarely gonococcal in origin. The tubal contents being sterile and the tubal mucosa normal, except for the results of intratubal pressure, these cases offer the most favorable results from salpingostomy.

One of the chief defects of a simple salpingostomy is that in a great number of cases the intramural portion of the tube, as well as the abdominal ostium, is occluded. To overcome this, hysterosalpingostomy has been devised. The usual after-histories of all forms of salpingostomy show that the newly formed ostia close and a recurrence of symptoms takes place, and this despite the utmost care displayed in performing the operation. The percentage of cases in which pregnancy takes place after salpingostomy has been performed is small, whereas recurrences are frequent. Turk<sup>1</sup> reports 8 cases in which salpingostomy was performed, 2 of which subsequently became pregnant. With one exception the cases, however, are not recorded in detail, and the condition of the opposite tube is not stated.

Gellhorn,<sup>2</sup> Kehrer,<sup>3</sup> Martin,<sup>4</sup> Mackenrodt,<sup>5</sup> Skutsch,<sup>6</sup> Gersuny,<sup>7</sup> Pozzi,<sup>8</sup> and Stone<sup>9</sup> have all reported pregnancies following salpingostomy, while Polk,<sup>10</sup> Morris,<sup>11</sup> Bonifield,<sup>12</sup> Polak<sup>13</sup> (3 cases), and the author have had cases of pregnancy follow resection of a tube. McArthur<sup>14</sup> states that he has performed the operation of salpingostomy very frequently, and cannot recall a single successful physiologic result. Small or normal sized tubes, in which the abdominal ostia are open, may be freed of adhesions, but better results will usually be obtained by their removal. The author believes that unless there is some indication making maternity especially desirable, a conservative operation on the tubes should not be performed, and, when possible, the patient

<sup>1</sup> Turk, R. C.: New York Med. Jour., 1909, vol. lxxxix, p. 1193.

<sup>2</sup> Gellhorn, G.: Surg., Gyn., and Obst., July, 1911, p. 10.

<sup>3</sup> Kehrer, E.: Monats. f. Geb. u. Gyn., October, 1909.

<sup>4</sup> Martin: Quoted by Kehrer, E.: *Loc. cit.*

<sup>5</sup> Mackenrodt: Quoted by Kehrer, E.: *Loc. cit.*

<sup>6</sup> Skutsch: Quoted by Prochownik, L.: Monats. f. Geb. u. Gyn., 1900, vol. xxix, p. 453.

<sup>7</sup> Gersuny: Quoted by Prochownik: *Loc. cit.*

<sup>8</sup> Pozzi: Quoted by Prochownik: *Loc. cit.*

<sup>9</sup> Stone: The Virginia Med. Semi-Monthly, June 7, 1912, p. 105.

<sup>10</sup> Polk, W. M.: Quoted by Kelly, H.: Operative Gyn., first ed., 1889, p. 192.

<sup>11</sup> Morris, L. C.: Amer. Jour. Obst., 1910, vol. lxii.

<sup>12</sup> Bonifield, C. L.: Amer. Jour. Obst., 1903, p. 658.

<sup>13</sup> Polak, J. O.: Amer. Jour. Obst., 1910, vol. lxii, p. 676.

<sup>14</sup> McArthur, A. N.: Australian Med. Jour., February 12, 1912, p. 333.

should be advised as to the nature of her condition and the likelihood of failure, and should herself be the one to decide the nature of the operation.

Uffreduzzi<sup>1</sup> has reported the results of a series of experiments performed for the purpose of ascertaining the ultimate results of salpingostomy, Clado's tubo-ovarian anastomosis, and Gersuny and Döderlein's utero-ovarian anastomosis being employed. In this series 19 animals were utilized, and in all the results were disappointing, as far as the possibility of subsequent pregnancy was concerned.

The general unsatisfactory results obtained by conservative tubal surgery may be attributed to the fact that the great majority of tubal inflammations are of gonococcal origin. One of the chief characteristics of the gonococcus is its persistence. After having once established itself in a location suitable for its growth, it is practically ineradicable unless the affected area is so situated as to be easily accessible to local treatment. It has been shown that gonococci may lie dormant in the tube for prolonged periods, and this persistence of the organism accounts for many of the failures in conservative surgery.

The brighter side of conservative tubal surgery is observed when we consider those cases in which a normal tube exists on one side and a diseased tube on the other. In these cases the normal tube should be disturbed as little as possible. Excellent results have been obtained by this treatment, and comparatively few such cases require a secondary operation. When it is decided to perform a salpingectomy, the radical operation, *i. e.*, the removal of a wedge-shaped portion of the uterine cornua, together with the outer two-thirds or three-fourths of the intramural part of the tube, should be the operation of choice. The writer has recently seen two cases of cornual abscess and one case of intramural tubal pregnancy occurring in the stump left by a previous salpingectomy, when the intramural portion of the tube had not been excised.

#### CONSERVATIVE OVARIAN SURGERY

The ovary is the analogue of the testicle, and is nearly or quite as important as that organ. For this reason considerable surgical risks are justifiable for its preservation. The removal of diseased tubes merely renders the patient sterile, a condition that usually exists before operation is undertaken; whereas a double oöphorectomy, at least in a certain proportion of cases, converts a previously normal woman into a hopeless neurasthenic. The sudden onset of the artificial menopause, with its accompanying nervous symptoms, the in-

<sup>1</sup> Uffreduzzi, O.: *Annali di ostetricia e ginecologia*, 1911, vol. ii.



ability successfully to fulfil the marital relations, together with the mental effect produced by the cessation of the menses, and the knowledge that is more or less suddenly and forcibly brought to the woman's mind that she is prematurely aged, and that the possibilities of maternity have forever been removed—all these tend to render the patient miserable. There is no doubt that the age at which a double oöphorectomy is performed, together with the individual temperament of the patient, plays a very decided part in the after-history of these cases, and that some women bear the results of the operation much better than do others. Too much importance, however, cannot be placed on the age, as Peterson<sup>1</sup> has shown that some of the most serious after-effects follow the artificial production of the menopause in women between forty and forty-five years of age. Although some patients may be relatively little affected by the operation, more than half will suffer very severely, and in a definite proportion the result will be little short of appalling.

One has only to follow the after-histories of a few cases to be convinced of the disastrous effects of a double oöphorectomy. In a large series of cases in which both ovaries were removed Giles<sup>2</sup> found that the flushes and other symptoms of the artificial menopause continued for from three to four years in most cases, and in some individuals persisted for ten years. Severe mental depression occurs in from 10 per cent. to 33 per cent. of cases, whereas of 157 cases, 2 became insane. Sex instinct is entirely abolished in 16 per cent., and it is only a matter of time before this is entirely lost. It has been claimed that the preservation of one ovary is sufficient. This statement is based on the principle that "half a loaf is better than no bread." The patients upon whom a unilateral oöphorectomy is performed often menstruate scantily and undergo an early menopause.

Dickinson<sup>3</sup> states that a review of 200 cases in which conservation of one or both ovaries has been practised shows that even when the uterus has been removed, not more than 20 per cent. of the patients suffer from the surgical menopause. His results were better when both ovaries were spared than when one was removed, and that in the latter class of cases the menopause was likely to occur somewhat earlier than in the normal woman. Giles,<sup>4</sup> after a careful review of 1000 abdominal sections, of which 50 were unilateral salpingo-oöphorectomies for pelvic inflammatory disease, concludes that the removal

<sup>1</sup> Peterson, R.: *Amer. Jour. Obst.*, May, 1908.

<sup>2</sup> Giles, A. E.: *Jour. Obst. and Gyn. of Brit. Emp.*, March and April, 1910.

<sup>3</sup> Dickinson, R. L.: *Trans. Amer. Gyn. Soc.*, vol. xxxvi, p. 324.

<sup>4</sup> Giles, A. E.: *Jour. Obst. and Gyn. of Brit. Emp.*, March and April, 1910.

of one ovary causes irregularities, diminution, or cessation of the menstrual flow in a definite proportion of cases (16 per cent. of his), and that in a somewhat smaller proportion (12 per cent.) the sexual desire is lessened or abolished. In 133 of our own cases at the University Hospital in which one ovary had been removed, menstruation was diminished or irregular in 50.

Carmichael,<sup>1</sup> Valtorta,<sup>2</sup> and McIlroy<sup>3</sup> found that in animal experimentation, when one ovary was excised, there was a permanent compensatory hypertrophy of the other, and this doubtless takes place to a certain extent in women and may account for some of the irregular bleedings that occasionally follow unilateral oöphorectomy. McIlroy also states that the uterine function and nutrition seem to depend upon the ovarian secretion, as atrophy occurred after bilateral oöphorectomy. The myometrium was the first to show atrophy; the glands of the mucosa disappeared gradually, and the surface epithelium retained its normal condition the longest. The mammary glands and the external genitalia were likewise invariably atrophied. Atrophic changes in the uterus following the removal of the ovaries prior to the establishment of the normal menopause have been observed by Knauer,<sup>4</sup> Gigorieff,<sup>5</sup> Ribbert,<sup>6</sup> Halban,<sup>7</sup> Rubinstein,<sup>8</sup> and many others.

A further comparison between the tube and ovary shows that the essential structure of the tube, *i. e.*, the mucosa, is chiefly involved, whereas in the ovary, at least in gonococcal infections, the important constituents are destroyed only in the last stages of the disease. A peri-oöphoritis is the most frequent accompaniment of a pyosalpinx, and usually only in the advanced cases is an actual oöphoritis present. For this reason, when the primary source of the infection is removed, the ovary is prone to undergo resolution. In examining the histologic diagnoses of 490 ovaries removed consecutively for pelvic inflammatory disease at the University Hospital, the author found 266 cases of peri-oöphoritis, thus showing the relative frequency of this condition.

In this connection it must be remembered that this is a conserva-

<sup>1</sup>Carmichael, E. S.: Edinburgh Med. Jour., March, 1909, p. 242.

<sup>2</sup>Valtorta, F.: Ann. di ostet. e gin., July, 1911.

<sup>3</sup>McIlroy: Jour. Obst. and Gyn. of Brit. Emp., July, 1912.

<sup>4</sup>Knauer: Zent. f. Gyn., 1896, vol. xx, No. 2; also *ibid.*, 1898, vol. xxii, p. 201; also Wien. klin. Woch., 1899, vol. xii; also Arch. f. Gyn., 1900, vol. ix; also Stevens' Jour. of Obst. and Gyn., January, 1904, vol. v.

<sup>5</sup>Gigorieff: Zent. f. Gyn., 1897, vol. xxi.

<sup>6</sup>Ribbert: Arch. f. Entwickl.-Mechanik, 1898, vol. vii.

<sup>7</sup>Halban: Monats. f. Geb. u. Gyn., vol. xii, No. 4, p. 496.

<sup>8</sup>Rubinstein, H.: St. Petersburg. med. Woch., 1899, No. 31, p. 281.

tive clinic, and while probably all, or nearly all, the ovaries the seat of advanced inflammatory lesions have been removed, many organs that would have been classified under the head of peri-oöphoritis have been spared, so that the relative proportion of peri-oöphoritis and oöphoritis is even more marked than would appear from the foregoing figures. It is impossible to formulate any hard and fast rules governing the removal or conservation of an ovary, as this is dependent upon so many factors. Polak<sup>1</sup> emphasizes the fact that an enlarged ovary is not necessarily a diseased one.

#### **SALPINGECTOMY. OVARIAN CONSERVATION AND SUSPENSION OF THE UTERUS**

As has been repeatedly stated elsewhere, successful ovarian conservation after salpingectomy is dependent chiefly upon three factors: (1) The surgical judgment of the operator—it is obviously unwise to conserve an ovary in which the disease is of such a character as to make it certain that it will continue to progress after removal of the tube. (2) Non-interference with the blood-supply of the ovary. (3) Maintaining the ovary in a favorable position, preferably in its normal situation.

**Condition of the Ovary.**—The indications for or against oöphorectomy have previously been stated, and attention has been called to the necessity of studying the pathology *in situ*, the variety of the infection, the points bearing on the individual case, such as the age of the patient, her nervous temperament, the desire for maternity, the condition of the opposite ovary, the correlation of the circumstances attending each individual case, and the study of the after-histories of such cases previously operated upon. Even a small series of cases carefully studied is of much more value in perfecting the surgical judgment than is a large series superficially reviewed.

The importance of maintaining an adequate blood-supply to the ovary can hardly be overestimated. Lack of care in this respect is responsible for the majority of failures following this operation. Clinical and experimental investigation has repeatedly demonstrated that if the blood-supply is seriously impaired, enlargement, due to cystic degeneration and edema, and the production of symptoms often so severe as to require operation, will result. In the more favorable cases the cystic change is followed by atrophy. In considering the operation of salpingectomy, it is important to remember the results that follow ligation of a blood-vessel. When a vessel is tied off, its lumen, for a varying distance, becomes occluded by a

<sup>1</sup> Polak, J. O.: Amer. Jour. Med. Assoc., December 14, 1912, p. 2138.

thrombus, which in many cases extends to the main trunk from which the vessel originated, with the result that the thrombosed portion of the vessel becomes converted into a fibrous cord. Thus it must be borne in mind that when ligating an artery in the upper part of the broad ligament, the area supplied by the vessel, for some distance toward the cardiac side of the ligature, is obliterated. It is true that



FIG. 29.—DIAGRAM OF THE BLOOD-SUPPLY OF THE FALLOPIAN TUBE.

This drawing is the result of a large series of injections made for the purpose of ascertaining the tubal blood-supply, and although the small vessels vary somewhat in different specimens, the usual picture is that here represented. A group of blood-vessels supplies the ampulla of the tube. These vessels are almost constantly present. Another vessel supplies the isthmus. In about 15 per cent. of cases this vessel branches slightly above the ovary, forming two trunks before reaching the tube. At the point of the utero-ovarian anastomosis, just beneath the cornu of the uterus, one or two vessels are given off, which penetrate the myometrium immediately beneath the tube. It is of the utmost importance, when performing a salpingectomy and conservation of the ovary, that these vessels be ligated and not the underlying utero-ovarian anastomosis. If, inadvertently, the utero-ovarian anastomosis is included in the ligature, disturbance of the ovarian circulation, with subsequent cystic change of the ovary, is almost sure to occur.

the collateral circulation more or less compensates for this deficit. But when the blood-supply of the ovary and upper portion of the broad ligament is carefully studied, it can easily be seen how ligation *en masse*, such as is often practised during the performance of salpingectomy, is certain greatly to disturb the circulation of the ovary. If the chief vessels comprising the utero-ovarian anastomosis are ligated, as they may easily be unless the ligatures are introduced with

this point in mind, subsequent degeneration of the ovary is sure to occur. The utero-ovarian anastomosis is especially likely to be ligated at the uterine cornua, where the large vessels approach the tube somewhat closely.

Clark<sup>1</sup> has shown that the primordial follicles that normally develop in the substance of the ovary reach the surface as a result of two factors, namely, increase in size and the fact that they are pushed to the periphery by the constant pulsation of the ovarian arteries behind them. It would seem safe to assume that when the ovarian circulation is impaired, the ovarian arteries pulsate with less force, so that although the maturing follicle might reach the periphery of the ovary, the arteries would not possess sufficient pulsating force to produce a necrosis of the tunica albuginea, lying between the follicle and the surface, and which, in the normal ovary, occurs just before the rupture of the follicle. Under such circumstances the follicle, coming in contact with the dense and perhaps thickened tunica albuginea, would fail to rupture and result in a retention cyst. This the author believes to be one of the chief reasons why cystic degeneration follows impairment of the blood-supply in this locality. The peri-oöphoritis which results in thickening of the capsule of the ovary that is often present, and the impairment of the return venous circulation, as suggested by Brown,<sup>2</sup> which causes edema, are also contributing factors.

No matter how carefully the ovarian blood-supply is conserved at operation, if the ovary is allowed to prolapse, dyspareunia is sure to occur, and edema and cystic degeneration, due to deranged blood-supply, are likely to follow. If, on the other hand, the mesosalpinx is put on the stretch by improper ovarian suspension, the lumen of the ovarian vessels is decreased as a result of tension, and a similar result takes place. In other words, the correct introduction of ligatures and suspension of the ovary are both essential for the proper maintenance of the blood-supply and hence to successful ovarian conservation. If the ovarian circulation cannot be properly conserved, oöphorectomy should be performed.

Two other important factors contribute to the ultimate success of this type of operation: these are the suspension of the uterus and careful peritonealization. In cases of pelvic peritonitis the great majority of uteri are more or less retrodisplaced. No matter how carefully the salpingectomy and ovarian suspension have been performed, if the uterus is left in a posterior position, subsequent trouble is likely to

<sup>1</sup> Clark, J. G.: Contributions to the Science of Medicine, 1900.

<sup>2</sup> Brown, L. R.: Jour. Amer. Med. Assoc., December 14, 1912, p. 2140.



FIG. 30.—PHOTOGRAPH SHOWING THE ARTERIAL BLOOD-SUPPLY OF THE NORMAL TUBE, OVARY, AND UTERUS  
(The author is indebted to Dr. John A. Sampson for supplying this excellent photograph.)





FIG. 31.—BILATERAL SALPINGECTOMY, OVARIAN CONSERVATION, AND SUSPENSION OF THE OVARY AND UTERUS.

First step: The blood-vessels supplying the ampulla and isthmus of the Fallopian tube have been ligated, and the ends of the former ligature left long for a tractor. The tube has been excised as far as its uterine attachment, and the ligature to control the vessels supplying the intramural portion of the tube has been inserted, but not tied. A broad cuff of mesosalpinx has been conserved above the ovary. (The suture to control the subutal vessels should be passed somewhat more deeply into the uterus than shown in the above.)



occur. These details are repeated here because the author believes them to be of great importance, and hence will explain the necessity for the steps in the following operation in contradistinction to the older methods of salpingectomy.

*Operation.*—A median incision of sufficient length to allow a free exposure should be made. With the patient completely anesthetized and in the Trendelenburg position, the intestines are packed back. Thorough walling off of the upper peritoneal cavity is an important step in all abdominal operations for pelvic inflammatory disease. Adhesions are then separated, especial care being taken to free the tube throughout its length from adhesions that may bind it to the ovary or broad ligament. This is of importance so that as broad a portion of the mesosalpinx as possible may be present before excision of the tube is begun. A fine catgut suture is then passed through the upper portion of the mesosalpinx, about 0.5 or 0.75 cm. below the tube, and about 1.5 or 2 cm. from the outer edge of the infundibulopelvic ligament. This is tied, and the ends are left long for use as a tractor. This ligature controls the blood-vessels supplying the distal centimeter or two of the tube. The outer end of the tube is then grasped with a hemostat, and the tube cut from the mesosalpinx to a point about 0.5 cm. from its uterine extremity, especial care being taken to incise the mesosalpinx through its extreme upper border, so as to leave the blood-supply of the ovary unimpaired, and a broad cuff of mesosalpinx above the ovary for future use in the ovarian suspension. After separating the tube from the mesosalpinx one or sometimes two blood-vessels are commonly seen spurting in the regions that lie beneath the inner portion of the ampulla of the tube and the isthmus. In his injection work the author has found one vessel quite constantly in this locality. This bleeding is now secured with a fine catgut ligature, care being taken to pass the ligature through the upper borders of the cut edge of the mesosalpinx, and to tie it in such manner that the latter is not puckered. By puckering the free edge of the mesosalpinx the latter is shortened, and the underlying blood-vessels are also puckered to a greater or lesser extent and the circulation thereby impaired. If the sutures are passed through the mesosalpinx at some distance from its cut edge, more blood-vessels than are necessary are ligated, with a similar result. Only sufficient mesosalpinx should be included in this suture to secure safe anchorage for the ligature. By separating the tube from the mesosalpinx as just described, before ligating, the individual vessel or vessels may be more easily picked up, fewer sutures are required, and puckering is less likely to occur. As an extra precaution against infection the tube may at this point be wrapped in a piece of sterile

gauze. A suture should next be passed through the lateral uterine wall, *immediately* beneath the intramural portion of the tube. Especial care should be observed to see that this suture embraces only the extreme upper and inner edge of the mesosalpinx. If the suture is passed deeply into the broad ligament, the utero-ovarian anastomosis may be ligated. The author's injection work has shown that there is always one and sometimes two branches given off from the utero-ovarian anastomosis at this point, and that these enter the uterus immediately beneath the tube—the subtubal vessels; it is to control these vessels that this ligature is employed. The intramural portion of the tube is excised with the ordinary wedged-shaped incision, and the uterine wound closed with two or three interrupted fine catgut sutures. Richardson's<sup>1</sup> single or double figure-of-8 suture serves admirably for this purpose.

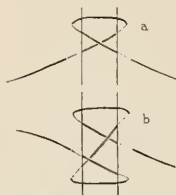


FIG. 32.—RICHARDSON'S SINGLE (a) AND DOUBLE (b) FIGURE-OF-8 SUTURE (Richardson, E. H.: Jour. Amer. Med. Assoc., May 7, 1910).

The round ligament is now picked up at a point about 2 or 3 cm. from the uterus, and drawn up and plicated, by means of two or three fine Pagenstecher sutures, over the uterine wound. If it is deemed advisable, a greater portion of the round ligament may be utilized—enough to bring the uterus forward in good position. This procedure shortens the round ligament, elevates it in the pelvis, suspends the uterus, and covers in the uterine salpingectomy wound and the inner two-thirds or three-fourths of the raw edge of the mesosalpinx. The extreme upper edge of the cuff of mesosalpinx above the ovary is then

sutured to the round ligament by means of two or three catgut sutures, the same care being observed in passing these sutures through the mesosalpinx as was taken in ligating the blood-vessels. Except that the ovary is drawn forward 1 or 2 cm., its normal position is retained, the organ hanging naturally on the posterior surface of the broad ligament. Even an enlarged and heavy ovary can be well suspended in this manner. If, however, the ovary to be conserved is the seat of one or two large retention cysts, it is a better plan to puncture these and thus reduce the weight of the organ. The operation may cease at this point, as practically all the requirements have been fulfilled. If the peritoneum is not too adherent, the author prefers to utilize this structure also for the uterine suspension. Coffey<sup>2</sup> has shown its great value in this connection. The peritoneum on the anterior surface of the broad ligament, at a point about 3 cm. below and 1 cm. outside of the

<sup>1</sup> Richardson, Edward H.: Jour. Amer. Med. Assoc., May 7, 1910, vol. liv, p. 500.

<sup>2</sup> Coffey, Robert C.: Surg., Gyn., and Obst., October, 1910.

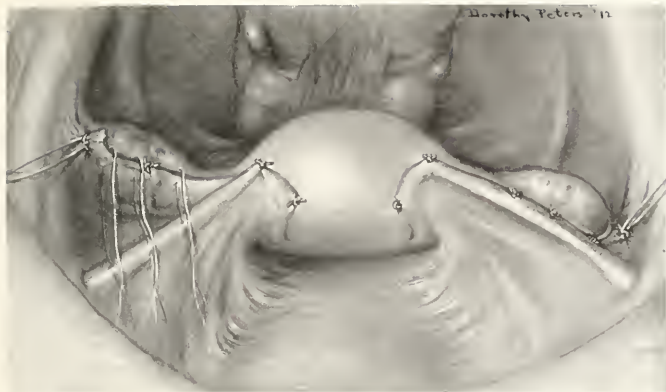


FIG. 33.—BILATERAL SALPINGECTOMY, OVARIAN CONSERVATION, AND SUSPENSION OF THE OVARY AND UTERUS.

Second step: Hemostasis has been secured, as shown in the previous illustration, and the wounds left from the excision of the intramural portion of the tubes have been closed by two or three interrupted sutures of fine catgut or by Richardson's figure-of-8 stitch. The round ligaments have been plicated over the uterine wound by two or three Pagenstecher threads, sufficient of the ligaments being utilized to effect a suspension of the uterus. On the patient's right side of the ovarian suspension sutures are in place, but not tied, while on the left side the ovary has been suspended. If the peritoneum of the anterior layer of the broad ligament is unusually adherent, the operation may cease at this point.



FIG. 34.—BILATERAL SALPINGECTOMY, OVARIAN CONSERVATION, AND SUSPENSION OF THE OVARY AND UTERUS.

Third step: It is of advantage, when possible, to utilize the peritoneum of the anterior layer of the broad ligament as a suspension medium. For this purpose a point somewhat below and slightly outside of the uterine insertion of the round ligament is selected, and the peritoneum from here lifted up and sutured to the uterus over the plicated portion of the round ligament by a fine catgut suture, as shown in the illustration. The Cushing stitch is a good one for this purpose. If the stump at the outer end of the broad ligament is not covered by this procedure, entire peritonealization may be accomplished by a fine catgut suture.



origin of the round ligament, is lifted up and tacked over the plicated round ligament on the uterine cornua, so as to envelop the latter. This entirely covers all raw areas and adds materially to the strength of the uterine suspension. If the appendages of the opposite side are normal, the ordinary Coffey uterine suspension operation may be performed on that side. In cases in which it is necessary to perform a salpingo-oöphorectomy the same method of plication of the round ligament and peritonealization may be employed.

The salpingectomy, as previously described, although somewhat more tedious than the ordinary operation, has been productive of so much better results, so far as the ultimate ovarian conservation is concerned, that the author has practically abandoned all other methods in its favor. In one case in which an opportunity arose to examine the suspended ovary nearly one year after the suspension, the organ was found to be in excellent condition. In three other cases in which unilateral salpingectomy has been performed pregnancy has followed and the subsequent labors have been normal, and the uteri have retained their normal positions. An endeavor has been made to keep track of all cases, and a large number have been examined bimanually from time to time. In all those operated upon by this method good results have been obtained so far as ovarian conservation is concerned, and in no case, as far as has been learned, have degenerative changes taken place in the retained ovary, nor have any of these ovaries given rise to subjective symptoms. The proportion of cases in which normal menstruation has been retained after a salpingo-oöphorectomy on one side, and a suspension of the ovary by the foregoing means on the opposite side, is distinctly better than when other methods have been employed.

Before adopting the method just described, a number of operations for ovarian suspension have been tested in the Gynecologic Department of the University Hospital. At first the ovary was let alone after excision of the tube, and then an endeavor was made to suspend the ovary from the round ligament without plicating the latter. Neither of these operations was entirely satisfactory, and for a time the ovary was suspended from the cornua of the uterus. If mass sutures are employed in tying off the mesosalpinx, this structure becomes much puckered, and a false sense of ease is encountered in bringing the ovary to the uterine cornua. Such a procedure interferes materially with the ovarian circulation, and in a large proportion of cases degeneration of the ovary results.

**Partial Oöphorectomy.**—In some cases resection of an ovary offers favorable results. The presence of pus in the ovary is usually an indi-

cation for its removal. Esch<sup>1</sup> regards the pus contained in ovarian abscesses as peculiarly virulent. Many such cases are undoubtedly of puerperal origin, the pyogenic microorganisms having traveled directly through the broad ligament to the ovary. Notwithstanding this, in carefully selected cases resection may be performed with fairly good results. If it is found necessary to remove the opposite ovary, or if the abscess is a small one and is so situated that it may easily be excised, and even if only a small amount of ovarian tissue can be left behind, the sudden onset of the menopause is generally averted.

Stokes<sup>2</sup> has had three cases of pregnancy following complete removal of one ovary and at the same time the major portion of the opposite one, showing definitely that in suitable cases, and when the operation is properly performed, these ovaries functionate in a normal manner. Humiston<sup>3</sup> reports 112 cases with no mortality. The after-histories of 70 of these cases have been followed: 19 of the number have given birth to 21 children, and 3 have returned for a second operation. None of the cases included in this list have been operated upon less than three years ago. The condition of the opposite ovary is not stated.

Watkins<sup>4</sup> states that he resects small abscesses in the ovaries in young women, preferring to run the risk of secondary trouble to producing an early menopause. As yet he has had no unfavorable results.

In general it may be stated that resection of an ovary possesses a limited field of usefulness in gonorrheal conditions, the proportion of those cases that require a secondary operation being much higher than where an entire ovary is conserved. This is due to two factors: in the first place, resected ovaries are always diseased organs, and in the second place, apart from the mutilation necessary, the circulation is often interfered with by the ovarian sutures. These are necessarily passed deeply into the substance of the ovary, and as this organ is supplied by a central circulation, the latter is always more or less disturbed. Furthermore, the follicle-bearing portion of the ovary is usually the part diseased, and therefore the most important portion of the ovary is likely to be removed by resection. Polak,<sup>5</sup> in his painstaking study of the after-histories of these cases, remarks that all resected ovaries become much enlarged after the operation. In the favorable cases this enlargement begins to subside in about four weeks.

<sup>1</sup> Esch: *Zeitschr. f. Geb. u. Gyn.*, 1907, vol. lix, No. 1.

<sup>2</sup> Stokes, J. E.: *Old Dominion Jour. Med. and Surg.*, Richmond, 1911, vol. xii, p. 235.

<sup>3</sup> Humiston, W. H.: *Amer. Jour. Obst.*, January, 1913, p. 120.

<sup>4</sup> Watkins, T. J.: *Jour. Amer. Med. Assoc.*, December 14, 1912, p. 2140.

<sup>5</sup> Polak, J. O.: *Jour. Amer. Med. Assoc.*, October 23, 1909, p. 1382.

Turretta<sup>1</sup> has studied the after-results in a large series of ovarian resections, and speaks favorably of the operation in selected cases; he believes that the reparative power of the ovary is very great. Zacharias<sup>2</sup> has traced the after-histories of three cases, in each of which one ovary was removed and the other resected. In none of these patients did any untoward symptoms arise, and all were menstruating regularly several years after the operation. Pognat<sup>3</sup> believes firmly in the regenerative power of the ovary, and declares that new germinal epithelium is produced, together with the formation of new primordial and Graafian follicles. This latter statement, while interesting, must be confirmed by further observation before it can be accepted. Di Christina<sup>4</sup> believes that the cut surfaces of a resected ovary heal by connective-tissue production, and that the cicatrix is generally pushed to the surface. The author had the opportunity of examining histologically two ovaries upon which resection had been performed. Serial sections were made of these organs, and no confirmatory evidence was obtained that new ovarian tissue was produced to take the place of the resected portion. Both specimens were of nearly normal size. In one the scar could be distinguished macroscopically, whereas in the other it could be detected only microscopically as a thin line of avascular connective tissue on the surface. That compensatory hypertrophy—a very different process from regeneration—does take place seems to be certain. This belief is borne out by the study of clinical material and by the work of Carmichael and Marshall,<sup>5</sup> which has been discussed elsewhere.

The most favorable cases for resection are those in which a single retention cyst is present, and this is especially true when the cyst tends to become pedunculated. These single retention cysts should not be confused with cystic degeneration of the ovaries. The latter condition offers very poor results from any form of conservative surgery. Boldt,<sup>6</sup> in performing oöphorocystectomy, endeavors to save a portion of the ovary, and in 45 cases had only one bad result. The necessity for leaving the ovary with an unimpaired blood-supply cannot be overestimated, and if this is found to be impossible, oöphorectomy should be performed.

It has been stated that ovaries that are allowed to remain after removal of the uterus or of the corresponding tube give rise to subse-

<sup>1</sup> Turretta, S.: *Il Policlinico*, January 3, 1909.

<sup>2</sup> Zacharias, P.: *Zeit. f. Gyn.*, Leipzig, January 25, 1908.

<sup>3</sup> Pognat: Quoted by Di Christina: *Monats. f. Geb. u. Gyn.*, vol. xxii, No. 5.

<sup>4</sup> Di Christina: *Monats. f. Geb. u. Gyn.*, vol. xxii, No. 5.

<sup>5</sup> Carmichael, E. S., and Marshall, F. A. F.: *Brit. Med. Jour.*, 1907, vol. ii, p. 1572.

<sup>6</sup> Boldt, H. J.: *Trans. Amer. Gyn. Soc.*, Philadelphia, 1909, vol. xxxiv, p. 327.



quent trouble, often undergoing polycystic degeneration and becoming enlarged and tender, and sometimes prolapsing into Douglas' culdesac; or if this does not occur, that they become adherent and painful. Unfortunately, there is no doubt that this is sometimes the case. The author is, however, of the opinion that in these cases the fault lies not so much in the ovary, as in the method of performing the salpingectomy.

The important factors to be considered in conservative ovarian surgery are the maintenance of a proper blood-supply and the securing of the ovary in good position, preferably in its normal location in the fossa obturatoria (Waldeyer). If these two points are observed, cystic degeneration of the ovary, dyspareunia, and other distressing symptoms can be averted. Furthermore, this opinion is strengthened by the review of the after-histories of engrafted ovaries, which almost invariably become cystic. Souve,<sup>1</sup> in his exhaustive study of ovarian transplantation, finds that cystic degeneration almost uniformly supervenes. This, he believes, is due to an imperfect blood-supply. A similar conclusion is reached by Kawasoye,<sup>2</sup> McIlroy,<sup>3</sup> and others. Special attention should be directed to covering all raw areas, so that adjacent organs may not become adherent, and, by the formation of post-operative adhesions, cause as much discomfort as the original condition. All rough handling and trauma of the ovary during the operation should be avoided. In those cases in which a resection has been performed, especial care should be taken accurately to coaptate the cut surfaces of the ovary, but not to constrict the tissue in doing so. Fine catgut sutures should be passed in such a way that no dead space will remain. Absolute asepsis and hemostasis should be secured. Martin<sup>4</sup> very properly strongly emphasizes the necessity of checking all bleeding points in cases of pelvic inflammatory disease. No better culture-media exist than blood-clots. A fine needle and fine catgut are requisites to successful conservative ovarian surgery.

In conserving ovaries, as in all other forms of surgery, the ability to make the diagnosis while the affected organ is in situ is of the utmost importance, and for this reason surgeons should accustom themselves to study removed tissue with great care.

It is quite as important that the uterus, as well as the ovary, be left in good position. If no attention is paid to this detail, the uterus may, by exerting traction on the broad ligament, set up a disturbance

<sup>1</sup> Souve: *Bull. de la Soc. Anat. de Paris*, November, 1907.

<sup>2</sup> Kawasoye, M.: *Zeit. f. Geb. u. Gyn.*, 1912, vol. lxxi, Nos. 1 and 2.

<sup>3</sup> McIlroy, A. L.: *Jour. Obst. and Gyn. of Brit. Emp.*, July, 1912, p. 19.

<sup>4</sup> Martin, F. H.: *Surg., Gyn., and Obst.*, April, 1907, p. 501.

in the ovarian circulation or actually drag the ovary into a painful position.

#### OVARIAN CONSERVATION AFTER HYSTERECTOMY

Cases in which ovarian conservatism is possible when hysterectomy for pelvic inflammatory disease is demanded are rare, the general rule being that when it is necessary to remove the uterus, both ovaries are so diseased as to require their ablation. Indeed, bilateral oöphorectomy is usually the indication for the hysterectomy. Nevertheless, occasionally cases may be encountered, and when such is the case, the ovary or ovaries should be left behind. Conservative ovarian surgery after hysteromyomectomy has amply demonstrated the physiologic success of this procedure, as exemplified by the work of Polak,<sup>1</sup> Holzback,<sup>2</sup> Dickinson,<sup>3</sup> Kelly and Cullen,<sup>4</sup> Konstantinides,<sup>5</sup> Clark and Norris,<sup>6</sup> and many others. Polak<sup>7</sup> states that the nervous phenomena are more marked when the patient operated upon is in good health, and that the post-operative menopause occurs less often after total extirpation for pelvic inflammations than when the ablation is performed for fibromyomata. Dickinson<sup>8</sup> observes that conservation of ovarian structure after hysterectomy showed 80 per cent. of the patients to be free from disturbances of the surgical menopause. In married women the conservatism showed nearly uniform persistence of the sexual desire. Dickinson<sup>9</sup> strongly opposes the practice of removing normal ovaries when performing a hysterectomy at or near the menopause, on account of age. In cases of pelvic inflammations ovarian conservation should be governed by the same rules as previously suggested. The maintenance of the proper blood-supply is of the utmost importance, and unless this can be obtained and the ovary left in a position secure from prolapse, its removal is indicated. The author's custom has, in this respect, been similar to the operative procedures recommended by Polak,<sup>10</sup> who raises the ovary well up and suspends it from the round ligament, especial care being observed to avoid inflicting trauma on the ovary and to cover all raw areas. In 7 cases previously recorded<sup>11</sup> no ill effects have occurred, and the unpleasant phenomena of the surgical menopause have been absent.

<sup>1</sup> Polak: Surg., Gyn., and Obst., July, 1911.

<sup>2</sup> Holzback: Arch. f. Gyn., vol. lxxx, No. 2.

<sup>3</sup> Dickinson: Surg., Gyn., and Obst., July, 1911, p. 99.

<sup>4</sup> Kelly and Cullen: Myomata of the Uterus, first edition, 1909.

<sup>5</sup> Konstantinides, G.: Münch. med. Wochenschr., 1910, No. 9, p. 491.

<sup>6</sup> Clark, J. G., and Norris, C. C.: Surg., Gyn., and Obst., October, 1910.

<sup>7</sup> Polak: Surg., Gyn., and Obst., July, 1911.

<sup>8</sup> Dickinson: Surg., Gyn., and Obst., July, 1911, p. 99.

<sup>9</sup> Dickinson: *Loc. cit.*

<sup>10</sup> Polak: Surg., Gyn., and Obst., July, 1911.

<sup>11</sup> Clark, J. G., and Norris, C. C.: Surg., Gyn., and Obst., October, 1910.

## CONSERVATIVE UTERINE SURGERY

With our increased knowledge of the function of the ovaries, and with the cognizance that without these adjuncts the uterus is a useless organ, and that a better support to the roof of the vagina may be obtained by a supravaginal hysterectomy, most operators are agreed as to the advisability of performing a hysterectomy whenever a double oöphorectomy is required. Reed<sup>1</sup> has recently pointed out that such uteri, if allowed to remain behind, are frequently the cause of much suffering. Giles<sup>2</sup> found that in 62 cases in which a bilateral salpingo-oöphorectomy was performed the uterus subsequently gave trouble in 7, and 2 required a second operation. This observer presents the following table, showing the atrophic results following bilateral salpingo-oöphorectomy:

	UNDER TWO YEARS PER CENT.	UNDER FIVE YEARS PER CENT.	OVER FIVE YEARS PER CENT.	TOTAL NUMBER OF CASES
Uterus and vagina normal . . . . .	38	26.7	18	17
Uterus or vagina atrophied . . . . .	31	33.0	54	20
Uterus and vagina atrophied . . . . .	31	40.0	27	18
Total . . . . .				55

This is another argument in favor of removal of the uterus when it is found necessary to perform a double oöphorectomy.

Kerr<sup>3</sup> also emphasizes the importance of removing the uterus when a bilateral salpingo-oöphorectomy is necessary. Carmichael and Marshall<sup>4</sup> found that in young animals, when the ovaries were removed, the uterus underwent fibrous degeneration.

**Curetage.**—A thorough curetage and iodination of the uterine cavity should precede all abdominal operations for pelvic inflammatory disease. If a supravaginal hysterectomy is to be performed, this procedure lessens the danger of infection when the cervix is cut across. When the uterus is to be spared, curetage and the application of iodine not only increase the likelihood of a complete cure, but also lessen the dangers of infection from a uterus often the seat of a chronic endometritis, to the adnexa, which are not to be removed at operation. Stone<sup>5</sup> not only employs iodine routinely in the uterine cavity, but also irrigates the Fallopian tube through the abdominal incision when the oviduct is to be saved. He states that no unusual reaction follows irrigation of the tubes with a solution composed of 25 or 50 per cent.

<sup>1</sup> Reed: New York Med. Jour., March 5, 1910.

<sup>2</sup> Giles, A. E.: Jour. Obst. and Gyn. of Brit. Emp., March and April, 1910.

<sup>3</sup> Kerr, J. M. M.: Jour. Obst. and Gyn. of Brit. Emp., 1910, vol. xvii, p. 458.

<sup>4</sup> Carmichael, E. S., and Marshall, F. A. F.: Brit. Med. Jour., 1907, vol. ii, p. 1572.

<sup>5</sup> Stone: The Virginia Medical Semi-Monthly, June 7, 1912, p. 105.

of the tincture of iodine, but that there is, rather, diminished pain. Bovée<sup>1</sup> is a strong advocate of the employment of iodine in the uterine cavity prior to abdominal section.

#### THE CONDITION OF THE VERMIFORM APPENDIX IN CASES OF PELVIC PERITONITIS

The exact relationship existing between the vermiform appendix and the right uterine adnexa is difficult to determine accurately. The clinical fact that the appendix is frequently secondarily involved in cases of pelvic inflammatory disease is well known. The converse occasionally takes place, as observed by Watkins.<sup>2</sup> As regards the appendiculo-ovarian or Clado's ligament, little doubt remains as to the existence of this structure. It is, however, in the author's experience, far from constant, and indeed the cases in which it can positively be demonstrated constitute the minority. When it is present, it appears merely as a reduplication or thin fold in the loose peritoneum of the right iliac fossa. Deaver and Testu,<sup>3</sup> Treub, Dutilh, Olshausen, Krönig, and Döderlein<sup>4</sup> refer to Clado's ligament as a distinct anatomic entity, and believe that this structure can be regarded as a causative factor in the production of tubal disease complicating appendicitis. Kelly and Hurdon<sup>5</sup> and Hartmann,<sup>6</sup> while admitting the occasional presence of a thin fold of peritoneum which connects the cecum or meso-appendix with the infundibulopelvic ligament, positively deny that this structure is ever a vascular or a lymph communication between the ovary and the vermiform appendix, and this is the attitude taken by the majority of the present-day anatomists. Hyde<sup>7</sup> explains the frequent inflammatory lesions of the vermiform appendix found in connection with pelvic inflammatory disease on the ground of gravity, and believes that this plays an important part in producing such conditions. Increased peristalsis, the different bodily postures, a loaded cecum, a dislocated appendix, enteroptosis, and a long appendix with a correspondingly long meso-appendix, combined with gravity, Hyde<sup>8</sup> concludes, simply bring the appendix and adnexum into juxtaposition, whereas inflammatory lesions, present in either, with the localized peritonitis, are responsible for the adhesion of the one to the other.

Of late years many operators have made a practice of performing

<sup>1</sup> Bovée, J. W.: Amer. Jour. Med. Assoc., July 27, 1912, p. 252.

<sup>2</sup> Watkins: Amer. Jour. Obst., 1909, vol. lix, p. 635.

<sup>3</sup> Deaver and Testu: Quoted by Hyde, C. R.: Amer. Jour. Obst., June, 1911, p. 1059.

<sup>4</sup> Treub, Dutilh, Olshausen, Krönig, and Döderlein: Quoted by Jones, H. M.: Lancet, July 29, 1911, p. 295.

<sup>5</sup> Kelly and Hurdon: The Vermiform Appendix and its Diseases.

<sup>6</sup> Hartmann: Quoted by Jones, H. M.: Lancet, July 29, 1911, p. 295.

<sup>7</sup> Hyde, C. R.: Amer. Jour. Obst., June, 1911, p. 1059.

<sup>8</sup> Hyde, C. R.: *Loc. cit.*

an appendectomy in nearly all cases in which the abdomen is opened, regardless of the history of the case and the macroscopic appearance of the appendix. Von Rosthorn<sup>1</sup> has pointed out the fact that there is no other class of cases in which the appendix is so likely to be diseased as in pelvic peritonitis. Pankow<sup>2</sup> has examined 150 vermiform appendices from Krönig's clinic, which were removed in the course of gynecologic operations, and has found 113 diseased. Hermes, in 75 cases, found the appendix diseased in 53, and noted this condition more commonly in multiparæ than in primiparæ. Robb,<sup>3</sup> under similar conditions, removed 218 appendices and found 209 diseased. Legueu<sup>4</sup> states that of 17 appendices removed during the course of a right-sided or a double salpingectomy for salpingitis, 16 presented definite lesions, 15 of these being a peritoneal or subperitoneal inflammation, acute in character, and evidently occurring by way of the lymphatics.

In the University Laboratory of Gynecologic Pathology there are 327 appendices that were removed coincidentally with operations for pelvic peritonitis; of these, macroscopic examinations showed 207 diseased, whereas histologic examination showed 246 inflamed. The entire series presents the following results: Normal appendices, 81; peri-appendicitis, 100; chronic appendicitis (various forms), 111; concretion in appendix, 33; primary carcinoma of the appendix, 3. In quite a definite proportion of these appendices disease could not be detected macroscopically, whereas in none of the cases of cancer was the nature of the condition suspected until the organs reached the laboratory. The author believes that in all conservative or radical operations for pelvic inflammatory disease appendectomy should be performed unless there are unusual operative difficulties or the patient's general condition is such that a few minutes' additional anesthesia would be hazardous. Even normal appendices, if not removed, will frequently cause subsequent trouble. In the Gynecologic Department of the University Hospital we have been forced to operate on not a few cases in which the appendix had not been removed at a previous operation, and had subsequently become adherent or inflamed.

#### IMMEDIATE MORTALITY OF CONSERVATIVE SURGERY

That the radical operations carry with them a higher mortality than the conservative operations cannot be doubted. The following

<sup>1</sup> Von Rosthorn, A.: *Monats. f. Geb. u. Gyn.*, September, 1909, vol. xxx, No. 3.

<sup>2</sup> Pankow: *Beiträge zur Geb. u. Gyn.*, vol. xiii, No. 1.

<sup>3</sup> Robb, H.: *Trans. Amer. Gyn. Soc.*, Philadelphia, 1906, vol. xxxi, p. 334.

<sup>4</sup> Legueu: *La Gynécologie*, 1911, vol. xv, p. 145.

results, gathered from statistics from various sources, bear out this statement:

## STATISTICS COLLECTED FROM VARIOUS SOURCES

	CONSECUTIVE CONSERVATIVE OPERATIONS	DEATHS	PERCENTAGE OF DEATHS
Manton <sup>1</sup> .....	100	0	0.0
Robins <sup>2</sup> .....	20	0	0.0
Simpson <sup>3</sup> .....	475	4	0.8
Giles <sup>4</sup> .....	132	4	3.0
Dudley <sup>5</sup> .....	858	9	1.0
Brothers <sup>6</sup> .....	160	2	1.2
Brown <sup>7</sup> .....	10	0	0.0
Jewett, H. <sup>8</sup> .....	32	2	6.2
Gynecologic Clinic, University Hospital <sup>9</sup> .....	321	7	2.1
Total.....	2108	28	1.3

An analysis of our statistics shows that of the 7 deaths, 2 died of pneumonia and that 2 were nearly moribund at the time of operation, one dying on the table and the other within a few hours, both having had general peritonitis before the operation. One case died of obstruction; one of intestinal atony, and one of general post-operative peritonitis.

Martin<sup>10</sup> presents the following statistics from the Birmingham Hospital for Women:

OPERATION	NUMBER OF CASES	DEATHS	PERCENTAGE OF DEATHS
Unilateral oöphorectomy.....	22	0	0.0
Bilateral oöphorectomy.....	2	0	0.0
Unilateral salpingectomy.....	122	2	1.6
Bilateral salpingectomy.....	263	8	3.0
Vaginal incision.....	36	0	0.0
Various conservative operations on the appendages, such as ovarian resection, relief of adhesions, etc.....	392	2	0.5

## END-RESULTS OF CONSERVATIVE SURGERY

The chief object to be attained in all forms of surgery is to cure the patient with as little risk as possible. The possibility of relieving the immediate trouble, but in doing so superimposing a worse condition

<sup>1</sup> Manton, W. P.: Trans. Amer. Gyn. Soc., Philadelphia, 1906, vol. xxxi, p. 197.

<sup>2</sup> Robins, C. R.: Old Dominion Jour. Med. and Surg., Richmond, 1908, vol. vii, p. 185.

<sup>3</sup> Simpson: Jour. Amer. Med. Assoc., 1909, No. 15, vol. liii, p. 1175.

<sup>4</sup> Giles, A. E.: Jour. Obst. and Gyn. of Brit. Emp., March and April, 1910.

<sup>5</sup> Dudley, A. P.: Jour. Amer. Med. Assoc., vol. xli, No. 24, p. 1446.

<sup>6</sup> Brothers, A.: Jour. Amer. Med. Assoc., February 22, 1908, p. 595.

<sup>7</sup> Brown, G. V. A.: Jour. Michigan Med. Assoc., Detroit, September, 1908, vol. vii, p. 449.

<sup>8</sup> Jewett, H.: Jour. Obst. and Gyn. of Brit. Emp., 1907, p. 312.

<sup>9</sup> Clark, J. G., and Norris, C. C.: Surg., Gyn., and Obst., October, 1910.

<sup>10</sup> Martin, C.: Brit. Med. Jour., October 26, 1912, p. 1110.



than that from which the patient originally suffered, has previously been dwelt upon. Although the results may be good at the time of discharge from the hospital, it by no means follows that the patient will henceforward suffer no ill effects from the operation or have no recurrence of the original disease. The latter, possibly, is particularly likely to occur in conservative operations for pelvic inflammatory disease. The following are some of the end-results obtained in this class of cases by other operators.

Giles<sup>1</sup> cured 120 of 132 cases.

Polak<sup>2</sup> cured 106 of 300 cases.

Robins<sup>3</sup> had 20 cases and cured 20 cases.

In our series of 191 cases, 140 were cured, 40 improved, and 11 showed no improvement. In these cases only such patients were classed as cured as evinced no symptoms. No cases are included that were operated on during the past year, an important point in compiling statistics such as these, for by including recent cases recurrences cannot be known. The fact that removal of one ovary has a tendency toward diminishing the amount and duration of menstruation and establishing a somewhat earlier menopause than in the case of a patient possessing both these organs has previously been dwelt upon. In a certain proportion of cases, however, in which a unilateral oöphorectomy is performed, menorrhagia or metrorrhagia results. Brothers<sup>4</sup> reports this condition in 14 of his 66 cases. The symptom is usually transitory, and is probably due to disturbance of the vasomotor centers and of the entire genital tract, the cycle of which centers about the ovaries. In our series irregular, profuse menstruation was present for a short time in 97 cases, but after one year only 9 cases suffered from this condition, whereas 10 additional patients complained of irregularities without mentioning the character of the flow.

In this connection the work of Vertes<sup>5</sup> is especially interesting. This investigator reports the results of his observations in a series of 67 cases in which one or both ovaries were removed, the uterus being allowed to remain. In none of the cases was vaginal drainage employed, nor were any cases of extra-uterine pregnancy included, so that in no instance would extraneous features be called into play. Vertes' conclusions are as follows: If the interval between the last menstrual period and a unilateral oöphorectomy is longer than twelve or thirteen days, then bleeding which subsequently appears may be

<sup>1</sup> Giles, A. E.: *Jour. Obst. and Gyn. of Brit. Emp.*, March and April, 1910.

<sup>2</sup> Polak, J. O.: *Jour. Amer. Med. Assoc.*, October 23, 1909, p. 1382.

<sup>3</sup> Robins, C. R.: *Old Dominion Jour. Med. and Surg.*, Richmond, 1908, vol. vii, p. 185.

<sup>4</sup> Brothers, A.: *Jour. Amer. Med. Assoc.*, February 22, 1908, p. 595.

<sup>5</sup> Vertes, O.: *Gyn. Rund.*, 1912, vol. vi, Nos. 8 and 9.



regarded as a predisposition to a menstrual flow, and usually proceeds with the loss of a less amount of blood than during a normal menstrual period. If the interval between the last menstruation and the operation is less than twelve days, then the post-operative menstrual flow will be subject to delay. This circumstance may be explained by the fact that the function of the extirpated ovary must be taken up by the organ on the other side, but delay becomes progressively lessened until the remaining ovary has completely adjusted itself to the increased function. If the ovary which contains a maturing Graafian follicle has been left behind at the time of operation, the first post-operative period will appear at the normal time, and the delayed flow will manifest itself only in subsequent periods. After a bilateral oöphorectomy a normal menstrual period may appear subsequently to the operation if the interval between the last period and the operation does not exceed thirteen or fourteen days.

#### PREGNANCIES RESULTING AFTER CONSERVATIVE SURGERY

One of the greatest advantages of conservative operations over hysterectomy is the possibility offered these patients of subsequently becoming pregnant; even in patients who do not conceive, the possibility of childbirth is never positively withdrawn from them. The fact, however, that many of these cases do conceive is well known. Giles<sup>1</sup> found that of his patients who were married and under forty years of age at the time of operation, 25 per cent. became pregnant and went to term. The 19 women who had full-term pregnancies bore 25 children, and 5 other patients had miscarriages, while of our own 68 cases which were married and under forty years of age at the time of operation, and in which sterilization was not performed (bilateral salpingectomy), 17 patients have become pregnant and gone to term, and were delivered of living children. Three of these 17 patients have had two children each, while one has borne three. In none of the labors was anything more required than low forceps. In the series of 68 cases in which pregnancy was possible, in addition to the 22 children born there were 7 miscarriages, 3 of these occurring among the 17 women who had borne children. A peculiar case of pregnancy, not included in the foregoing group, occurred among our cases, and demonstrated the tendency of the Fallopian tube to become patent if it is simply tied off without excising the intramural portion. This patient was operated upon for double pus-tubes of unusual size. Both ovaries were densely adherent and one was much enlarged, due to the presence of a retention cyst. Both tubes and the cystic ovary

<sup>1</sup> Giles, A. E.: Jour. Obst. and Gyn. of Brit. Emp., March and April, 1910.

were removed. The patient took the anesthetic badly, and in order to save time the tube was tied off in the old-fashioned way on the side upon which the salpingo-oöphorectomy was performed. Convalescence was uninterrupted. Menstruation was regular, but rather scanty. Two years after the operation the patient became pregnant, and subsequently gave birth to a full-term, healthy child.

Numerous statistics relating to pregnancy following conservative pelvic surgery are on record, but most of these are misleading, because important details, such as the proportion of married patients, the age of the women, the amount of time that elapsed between operation and the compiling of the statistics, etc., are lacking.

	NUMBER OF CASES REPORTED	*SUBSEQUENT PREGNANCIES	PER CENT.
Polak <sup>1</sup> .....	240	26	10.0
Butler.....	50	1	2.0
Hyde <sup>2</sup> .....	21	1	3.8
Manton <sup>3</sup> .....	41	6	14.0
Robb, H.....	419	0	0.0
Baldwin, L. G. <sup>4</sup> (quoted by Hyde).....	99	0	0.0
Dickinson.....	50	0	0.0
Jewett <sup>5</sup> .....	67	0	0.0
Brothers <sup>6</sup> .....	160	0	0.0
Brown, G. V. A. <sup>7</sup> .....	10	1	10.0

Dudley,<sup>8</sup> after carefully reviewing the after-histories of 2168 cases, came to the conclusion that at least 10 per cent. become pregnant, whereas Hyde,<sup>9</sup> in summing up a large series of his own and of other operators' cases, believes that not more than 5 per cent. become pregnant. This latter proportion should probably be at least doubled if we take into consideration the age and condition of the patients from whom these statistics are computed, for it is obviously incorrect to include cases of women past forty or spinsters in these figures. It is interesting to note that in Polak's<sup>10</sup> series of cases, all of which were at the child-bearing age, 17 of the 26 pregnancies followed the ablation of the ovary on one side and the resection of the opposite organ.

<sup>1</sup> Polak, J. O.: Jour. Amer. Med. Assoc., October 23, 1909, p. 1392.

<sup>2</sup> Hyde, C. R.: Amer. Jour. Obst., August, 1907, vol. lvi, No. 2, p. 145.

<sup>3</sup> Manton, W. P.: Trans. Amer. Gyn. Soc., Philadelphia, 1906, vol. xxxi, p. 197.

<sup>4</sup> Baldwin, L. G.: Amer. Jour. Obst., 1907, vol. lv, p. 203.

<sup>5</sup> Jewett, H.: Jour. Obst. and Gyn. of Brit. Emp., 1907, p. 312.

<sup>6</sup> Brothers, A.: Jour. Amer. Med. Assoc., February 22, 1908, p. 595.

<sup>7</sup> Brown, G. V. A.: Jour. Michigan Med. Assoc., Detroit, September, 1908, vol. vii, p. 449.

<sup>8</sup> Dudley, A. P.: Jour. Amer. Med. Assoc., vol. xli, No. 24, p. 1446.

<sup>9</sup> Hyde, C. R.: Amer. Jour. Obst., August, 1907, vol. lvi, No. 2, p. 145.

<sup>10</sup> Polak, J. O.: Jour. Amer. Med. Assoc., October 23, 1909, p. 1382.

### POSSIBILITIES OF ECTOPIC PREGNANCY FOLLOWING CONSERVATIVE OPERATIONS

Giles<sup>1</sup> was one of the first writers to draw attention to the likelihood of ectopic gestation occurring subsequently to a conservative operation of the uterine adnexa. Of his patients, 7 subsequently became pregnant ectopically, whereas Polak<sup>2</sup> reports one cornual pregnancy following a radical salpingectomy. In our series of 68 cases 2 women were subsequently operated on for tubal pregnancy. These figures bear out the theory that the chief etiologic factor in the production of tubal pregnancy is pelvic peritonitis. If tubal pregnancy is particularly prone to follow conservative operations,—and these figures indicate that it is,—this factor must be taken into consideration in all conservative operations on married women of child-bearing age.

### PROPORTION OF CASES REQUIRING A SECONDARY OPERATION AFTER A CONSERVATIVE OPERATION

The fact that a very definite proportion of pelvic inflammatory cases subjected to conservative operation require a second operation for the recurrence of an old disease, or the further progress of the inflammation into organs hitherto unaffected, is the strongest argument in favor of the radical operation. The frequency with which the gonococcus is found as the infective agent in these cases, and also its persistence, together with the advantages to be derived from delayed operation, have previously been dwelt upon; but, nevertheless, even with the most careful preliminary treatment and the most prudent selection of cases a certain percentage of patients will require a secondary operation, as may be seen from the following table:

	NUMBER OF CASES REPORTED	CASES WITH SECONDARY OPERATIONS
Polak <sup>2</sup> .....	300	41
Baldwin <sup>3</sup> .....	99	1
Jewett <sup>4</sup> .....	67	6
Dickinson.....	50	4
Judd.....	50	2
Manton <sup>5</sup> .....	100	3
Giles <sup>6</sup> .....	52	4
Robb <sup>7</sup> .....	419	10
Brothers <sup>8</sup> .....	85	0
Cragin, E. B.....	33	1
Clark and Norris <sup>9</sup> .....	190	7

<sup>1</sup> Giles, A. E.: Jour. Obst. and Gyn. of Brit. Emp., March and April, 1910.

<sup>2</sup> Polak, J. O.: Jour. Amer. Med. Assoc., October 23, 1909, p. 1382.

<sup>3</sup> Baldwin, L. G.: Amer. Jour. Obst., 1907, vol. lv, p. 203.

<sup>4</sup> Jewett: Jour. Obst. and Gyn. of Brit. Emp., 1907, p. 312.

<sup>5</sup> Manton, W. P.: Trans. Amer. Gyn. Soc., Philadelphia, 1906, vol. xxxi, p. 197.

<sup>6</sup> Giles, A. E.: Jour. Obst. and Gyn. of Brit. Emp., March and April, 1910.

<sup>7</sup> Robb, H.: Amer. Jour. Obst., 1907, vol. lv. Thirteen other cases, however, were under observation for symptoms, 10 of which were subsequently cured without operation.

<sup>8</sup> Brothers, A.: Jour. Amer. Med. Assoc., February 22, 1908, p. 595.

<sup>9</sup> Clark, J. G., and Norris, C. C.: Surg., Gyn., and Obst., October, 1910.

Dührssen,<sup>1</sup> from an experience of 1000 cases, believes that not more than 2 per cent. require a second operation.

Thus we find that out of a total of 1445 cases of various operators, 85, or 5.8 per cent., require a secondary operation, and this is not taking into consideration the fact that many of these cases were not subjected to preliminary treatment prior to operation. The proportion of cases in which an apparently normal tube becomes diseased subsequent to the removal of the appendages of the opposite side is difficult to estimate, owing to the fact that the majority of the statistics on this subject are based upon such broad grounds. Giles,<sup>2</sup> however, has carefully followed the after-results of 44 such cases, and found that in but one did trouble arise. Of our 73 cases in which operations were performed on one side, the opposite tube being left undisturbed, a secondary operation was required 5 times. In 3 of the 5 cases in which a secondary operation was necessary the case histories show that both tubes were adherent at the time of operation, whereas in the other 2 cases no mention is made in the histories as to the condition of the tube.

#### CONCLUSIONS

1. With few exceptions all pelvic inflammatory cases should be subjected to a course of preliminary treatment before operation is undertaken. If this is done, some will escape operation entirely, whereas others can be operated on more easily, more quickly, and with lower mortality and morbidity. A greater number of cases will also be found to be suitable for conservative operation. If possible, the patient's temperature and blood-counts should be normal for from four to six weeks before operation.

2. If pus is present and can easily be reached without traversing the peritoneal cavity, it should be evacuated at once. In a small percentage of cases the symptoms may be of such a character as to preclude the possibility of delay. Accurate diagnosis and a careful study of the cases will, however, show that but a small proportion require emergency surgery.

3. The end-results of salpingostomies are, as a rule, disappointing. Pregnancy rarely takes place, as the newly formed ostia quickly become occluded and cause a recurrence of symptoms.

4. Conservation of a grossly normal tube in the presence of diseased appendages on the opposite side offers good results, especially if

<sup>1</sup> Dührssen, M.: *Trans. Amer. Gyn. Assoc.*, Philadelphia, 1906, vol. xxxi, p. 197 (discussion of Dr. Manton's paper).

<sup>2</sup> Giles, A. E.: *Jour. Obst. and Gyn. of Brit. Emp.*, March and April, 1910.

a course of preliminary treatment has been carried out prior to operation.

5. Conservation of macroscopically diseased tubes is unsatisfactory.

6. Conservative ovarian surgery offers excellent results, provided that the ovarian circulation is not impaired and that the organ is left in a good position. This is strikingly exemplified in our series of 48 double salpingectomies when one or both ovaries were spared, none of these cases requiring a second operation.

7. In selected cases ovarian resection offers excellent results. If a small amount of ovarian tissue is left behind, this will usually avert the sudden onset of the menopause. The reason that many resected ovaries become cystic is because of the interference with the blood-supply.

8. When it is found necessary to remove both ovaries, a hysterectomy should nearly always be performed. Such uteri are useless and often give rise to subsequent trouble.

9. If it is found necessary to remove the uterus and one or both ovaries can be spared, their preservation will prevent the unpleasant symptoms attending the artificial menopause; for although menstruation will cease, the neuroses, which are the most distressing symptoms of the menopause, will be absent.

10. A thorough curetage and iodization of the uterine cavity should precede all abdominal sections for pelvic inflammatory disease. Areas of infection in the lower genital tract should subsequently receive appropriate treatment.

In order to obtain correct statistics regarding the after-results in these cases a circular letter was sent to each patient. In those cases that failed to reply a letter was sent to the patient's family physician. In these letters special inquiry was made as to the condition of the menstrual function, leukorrhea, dysmenorrhea, abdominal pain, pregnancies, miscarriages, operations, or illnesses. Those patients who lived in the city or who did not feel entirely well were asked to return to the hospital for examination. A number of patients complied with this request, so that, in addition to the reply to our circular letter, many of our cases have been personally examined. No patient was classed as cured unless she or her physician considered that a cure had been effected, nor were any cases regarded as cured unless they were entirely free from pelvic symptoms. Thus, if a patient complained of dysmenorrhea, she was classed as improved or unimproved, according to the severity of condition. As has been shown by the work of Marie Tobler,<sup>1</sup> from 50 to 75 per cent. of all women suffer more or less at

<sup>1</sup> Tobler, M.: *Monats. f. Geb. u. Gyn.*, 1905, vol. xxii, p. 1.

TABLE SHOWING THE POST-OPERATIVE RESULTS OF CONSERVATIVE OPERATIONS IN 188 CASES OF PELVIC INFLAMMATORY DISEASE

OPERATION	Total	Cured	Improved	Not Improved	Menstruation Regular, Normal	Regular, Scant	Regular, Profuse	Irregular	Irregular, Scant	Irregular, Pro- fuse	Dysmenorrhea	Normal Preopera- tives	Ectopic Preopera- tives	Miscarriages or Abortions	Neurasthenic Be- fore Operation and Unimproved	Second Operation Required	Amenorrhea Since Operation
Unilateral salpingostomy	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bilateral salpingostomy	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Unilateral salpingectomy	18	11	6	1	10	1	1	3	1	1	4	2	1	1	2	1	1
Bilateral salpingectomy	14	11	3	1	9	1	1	1	1	1	3	1	1	1	2	1	1
Unilateral salpingo-oophorectomy	81	58	18	5	34	14	2	4	6	1	6	14	1	4	2	5	1
Salpingectomy on one side and oophor- ectomy on the other	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bilateral salpingectomy and unilateral oophorectomy	58	44	10	4	27	16	1	2	3	4	1	1	1	1	2	1	1
Unilateral resection of the ovary	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bilateral resection of the ovaries	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Supravaginal hysterectomy. Bilateral salpingectomy and unilateral oophor- ectomy	7	7	1	1	1	1	1	1	3	1	1	1	1	1	1	1	3
Unilateral salpingo-oophorectomy and salpingostomy	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
Totals	188	137	39	12	84	33	3	10	13	6	14	17 <sup>1</sup>	2	7	6	7	3

<sup>1</sup> Seventeen patients bore 22 children.

the menstrual periods, and it seems probable that some of the cases in the series under consideration that were classed as improved would actually compare very favorably with the average woman. No cases were included in this series that had been operated upon during the past year, whereas some of them are of eleven years' standing. One case of unilateral salpingo-oöphorectomy was well for two years, when a miscarriage occurred, and infection followed, requiring a secondary operation. This case was classed as unimproved, as was another case of unilateral salpingo-oöphorectomy who was entirely well for thirteen months, when trouble recurred requiring a second operation. A case of bilateral salpingectomy and unilateral oöphorectomy was well for two years, when, while lifting a heavy weight, the patient felt something "give way" in her abdomen and a uterine prolapse resulted; she was classed as unimproved. Following one of the ovarian resections the ovary became enlarged to the size of a lemon, and gave considerable trouble. Three months after operation, however, it was not palpable, and no symptoms were present. Seven years after the operation the patient was menstruating regularly and painlessly. This case was classed as cured. In nearly all the cases dilatation and curetage were performed, together with a suspension operation; in some cases ventral suspension, in others, the Gilliam operation, and in the more recent cases, the Coffey operation, was done; ventral fixation was performed in some of the cases in which both tubes were excised.

#### HYSTERECTOMY AND BILATERAL SALPINGO-OÖPHORECTOMY FOR PELVIC INFLAMMATORY DISEASE

**Indication.**—Under the heading Conservative Uterine Surgery it was stated that when it becomes necessary to remove both ovaries, a hysterectomy is indicated in nearly all cases. It is true that Webster<sup>1</sup> and Freund have utilized the uterus to cover a rent in the pelvic peritoneum or rectum after the ablation of both tubes and ovaries. Further autoplasmic surgery has been reported by Judet,<sup>2</sup> Quénu,<sup>3</sup> Sneguireff,<sup>4</sup> Summers,<sup>5</sup> Kelly,<sup>6</sup> and others.

Cases in which uterine autoplasmic surgery are necessary are, however, of extreme rarity, and carefully applied sutures usually answer the same purpose, and offer better hope of effecting a permanent symptomatic cure. As has previously been pointed out, uteri, if left in

<sup>1</sup> Webster, J. C.: *Gynecology and Abdominal Surgery*, Kelly and Noble, vol. i, p. 622.

<sup>2</sup> Judet: *La Rev. de Gyn. et de Chir. Abdom.*, December, 1900.

<sup>3</sup> Quénu: *Trans. French Surgeons*, Paris, 1899.

<sup>4</sup> Sneguireff, V. T.: *Klin. Jour.*, Moscow, 1900, No. 1, p. 1.

<sup>5</sup> Summers: *Surg., Gyn., and Obst.*, August, 1911.

<sup>6</sup> Kelly, H. A., and Noble, C. P.: *Gynecology and Abdominal Surgery*, first edition.



place after the removal of both tubes and ovaries, not infrequently give rise to subsequent trouble. The indications for performing a hysterectomy and bilateral salpingo-oöphorectomy have been extensively dealt with under the heading of Conservative Surgery of the Adnexa.

Not a few cases will be observed in which, on account of the extent of the disease, no other form of treatment can be considered, and in these the choice of operation lies between a supravaginal hysterectomy and a total removal of the entire uterus and cervix. The supravaginal amputation is the operation most frequently employed. This operation is more easily and quickly performed, and if the amputation is made at a low level, the cervix well cupped out, the canal widely dilated, the mucosa destroyed by the actual cautery, and the round ligaments utilized for suspension purposes, equally good, if not better, results are obtained in the majority of cases than follow a panhysterectomy. It is imperative that all the mucosa of the cervical canal be destroyed. By retention of the cervix the anchorage of the uterosacral ligaments is retained, which materially aids in the suspension of the latter structure.

Some surgeons prefer to remove the cervix in all cases. Schiffman and Patek<sup>1</sup> state that their panhysterectomy cases have been more satisfactory than have been those in which the supravaginal operation has been performed. The surgeon should, however, be largely guided by the conditions present in the individual case. If cervical leukorrhea has been a pronounced symptom, and if this organ is heavy and greatly hypertrophied or presents an extensive laceration, and especially if a marked degree of eversion or cervicitis is present, a panhysterectomy is indicated.

Several authors have reported the appearance of a bloody flow at irregular intervals following supravaginal amputation. But this may in most instances be ascribed to imperfect technic. To obviate this, Chaput,<sup>2</sup> after the removal of the uterus and adnexa in the usual way, makes an incision into the anterior vaginal vault, slits the cervix, everts it, and excises the mucosa; he then sutures it in its original form, and invaginates it and closes the vagina above. de Rouville<sup>3</sup> recommends vigorous curetage of the cervical canal after supravaginal removal of the uterus. He scrapes out the canal with circular sweeps of a bistoury until only a thin shell a few millimeters thick remains. The operation is then concluded in the ordinary manner. These procedures have no advantages in ordinary cases over the operation already recommended.

<sup>1</sup> Schiffman and Patek: *Monats. f. Geb. u. Gyn.*, 1911, vol. xxxiii, p. 310.

<sup>2</sup> Chaput: *Rev. de Gyn.*, August, 1910.

<sup>3</sup> de Rouville: *Rev. Prat. d'Obstet. et de Gyn.*, Paris, October, 1912, vol. xx, No. 10.

It would seem that the immediate mortality of panhysterectomy should be slightly greater than in the less radical operation, as in the former the vagina is opened and the operation is more extensive. A study of statistics, however, fails to show any marked degree of difference. As a means of lessening the dangers of post-operative infection in these cases de Rouville<sup>1</sup> recommends sterilization of the vagina with iodine. He reports 66 hysterectomies, of which 40 were sub-total and 26 total, with 2 deaths, neither of which was caused by infection.

The question of cancer occurring subsequently in the cervical stump is worthy of consideration. If the cervical mucosa is destroyed by the cautery, this is extremely unlikely. Such cervixes atrophy, and malignant changes are of extremely rare occurrence. Among 757 supravaginal hysterectomies performed for various causes in the Gynecologic Department of the University of Pennsylvania during the last twelve years, not a single known case of cervical cancer has occurred, although about half of the cases have been traced.<sup>2</sup> Giles<sup>3</sup> asserts that the fate of the cervical stump after supravaginal hysterectomy need cause no apprehension. Of 181 of his cases not one showed any signs of malignancy, and in 98.3 per cent. no trouble of any kind was caused by the retention of the cervix. The immediate mortality in our series of 69 cases, in the majority of which supravaginal hysterectomies were performed, was 5.7 per cent. This includes death from all causes. One case died of post-operative peritonitis, one of volvulus, and two of heart and respiratory failure, in one of which the ether is believed to have been the contributing cause. Baldy<sup>4</sup> states that in a series of 223 cases of hysterectomy performed by himself and five other operators, the mortality was 2.68 per cent. It is not stated whether this represents the total number of deaths or is only the immediate operative mortality. Davis<sup>5</sup> reports a series of 22 cases in which hysterectomy and bilateral salpingo-oophorectomy were performed, in which the immediate mortality was 13.6 per cent. It should, however, be stated that many of these cases were complicated, all were drawn from free patients, and in all drainage was employed. A report from the von Herff clinic<sup>6</sup> showed that of 45 drained cases, the mortality was 24.4 per cent. These and other statistics indicate that hysterectomy

<sup>1</sup> de Rouville: Bull. de la Soc. d'Obstet. de Paris, February, 1911.

<sup>2</sup> Since the above was written a case has occurred. Operation thirteen years prior to the development of the cancer.

<sup>3</sup> Giles, A. E.: After-results of Abdominal Operations, 1910, p. 57.

<sup>4</sup> Baldy: Kelly and Noble, Gynecology and Abdominal Surgery, first edition, vol. i, p. 650.

<sup>5</sup> Davis, E. P.: Amer. Jour. Obst., September, 1911.

<sup>6</sup> Report of the Sixth International Congress of Obstetricians and Gynecologists, Berlin, September 9 to 13, 1912.

carries with it a greater mortality than the less radical operation. Of the 321 cases of conservative operation previously referred to from the Gynecologic Clinic of the University Hospital, the mortality was 2.1 per cent. This includes deaths from all causes. In a series of 2108 conservative operations performed by various surgeons, the total mortality was only 1.3 per cent.

Of 31 consecutive cases of hysterectomy and bilateral salpingo-oophorectomy for pelvic inflammatory disease, the after-histories of which could be traced, 24, or 77.4 per cent., are completely cured, 5 are improved, and 1 shows no improvement. This last case improved for about a year. Her symptoms were chiefly due to the artificial menopause. One year after the operation she had a stroke of apoplexy, and has been in ill health ever since. The chief symptoms from which the 4 improved cases suffered were constipation, and in 3, dyschesia. The pain in 2 of these cases was apparently due to adhesions. All these patients were of a constipated habit before operation. Twelve of the 24 cured cases suffered from constipation before the operation, but are now normal. In none of the cases was there any pathologic leukorrhea following the operation.

Giles<sup>1</sup> summarizes the results of 18 cases of total extirpation for inflammatory disease, and finds that a very marked improvement occurred in 17 of his cases, and also that in many of the women the sexual desire remained unaltered. In only 4 of the 18 cases, however, has the operation been performed more than two years before the report was issued. That the sexual appetite is not immediately lost after a panhysterectomy is well known. The excision of appendages the seat of inflammatory disease often removes the cause of a preëxisting dyspareunia, and patients state that following the operation sexual desire is increased. The proportion of cases in which sexual desire is strong five years after the removal of both ovaries is extremely small. In 22 of the 31 cases of hysterectomy and bilateral salpingo-oophorectomy the after-histories of which we have been able to obtain, the vermiform appendix was removed at the time of the hysterectomy. Fifteen of the appendices were diseased.

#### DRAINAGE IN CASES OF PELVIC INFLAMMATORY DISEASE

The same indication for drainage exists in cases of pelvic inflammatory disease as exists in operations for other pelvic lesions. The old dictum of "when in doubt, drain," has been reversed, so that now we say, "when in doubt, do not drain." The small proportion of cases that require drainage may be largely accounted for by the generally

<sup>1</sup> Giles, A. E.: After-results of Abdominal Operations, 1910, p. 198.

adopted system of not operating upon acute cases and by an improved operative technic. The use of the round-pointed needle and of cat-gut has practically done away with the employment of a gauze pack to control hemorrhage. At the University Hospital the inflammatory cases that are drained are those in which, for some reason, it has been found impossible to remove the entire abscess-sac, or when it has been necessary to leave behind a large amount of lymph. Drainage is also occasionally employed in those rare cases in which the small intestine, rectum, sigmoid flexure, urinary bladder, or ureter have been severely injured. Under such circumstances care must be observed to avoid too tight packing or placing the gauze too near the defective hollow viscus. If the drain is placed in direct apposition to the stitches, an intestinal fistula is likely to occur. The plan should be to have the drainage sufficiently near the suspected area to guide away any leakage that may occur, but not to come in immediate contact with the stitches. Such cases are very infrequent. In pelvic operations the operator has the choice of two routes of drainage—the abdominal and the vaginal. Unless contraindicated, the vaginal route offers many advantages.

In 1897 Clark<sup>1</sup> stated that "if the pelvis is to be drained, the vaginal route is preferable: the dangers of infection are no greater, and the dependent pockets in the pelvis can be drained much more effectively by this means." Olshausen<sup>2</sup> summarizes his opinion as follows: "In doubtful cases of deep-seated pelvic suppuration in women vaginal drainage is more reasonable than suprapubic."

The material selected for drainage is usually sterile gauze, and in some cases combinations of gauze and soft rubber. For vaginal drainage Bovée<sup>3</sup> employs a soft-rubber tube, one-half inch or more in diameter. The upper end of the tube had two lateral arms, each one inch in length, that overlap the uterosacral ligaments. These prevent the expulsion of the tube. Silk has been advocated by some authorities; the author has had no personal experience with this material. Among the last 100 cases operated upon for pelvic inflammatory disease in the Gynecologic Department of the University Hospital, drainage has been employed once. In all cases when the culdesac drainage is employed, the vaginal opening should be a free one. When gauze drainage is effected through the vagina, the custom at the University Hospital is to start the removal of it on the fifth day, and have the gauze entirely removed by the seventh day. Repacking is not necessary, and is, indeed, dangerous, because of the

<sup>1</sup> Clark, J. G.: *Amer. Jour. Obst.*, 1897, vol. xxxv, p. 656.

<sup>2</sup> Olshausen: *Zeit. f. Geb. u. Gyn.*, vol. xviii, No. 2.

<sup>3</sup> Bovée, J. W.: *Jour. Amer. Med. Assoc.*, July 27, 1912, p. 251.

possibilities of infection and breaking up of adhesions. When tubal drainage is employed, vaginal irrigation may be given on the second or third day, but care must be taken that no force is used, the idea being only to wash away discharges; adhesions must not be broken up. To obtain a wide opening for drainage v. Toth<sup>1</sup> advocates splitting through the entire length of the posterior cervical wall after performing an ordinary supravaginal hysterectomy. The incision is carried along the posterior vaginal wall for a greater or less distance, depending upon circumstances. Two sutures are introduced at each vaginal edge to arrest hemorrhage, and two sutures are placed on each side of the cervix through the thickness of the wall. The outer parts of the broad ligaments are closed in the usual way, and the anterior peritoneal flap is drawn across and united to the cervix along the isthmal aspect. If desired, the pelvis can be shut off from the drainage tract by bringing the sigmoid flexure across and suturing it to the anterior peritoneal flap. We see little advantage in thus splitting the cervix, and believe that a wide lateral incision through the culdesac is preferable. The utilization of flaps of peritoneum, or even the sigmoid flexure to wall off the drainage tract from the general peritoneal cavity is an excellent procedure, and has for years been utilized in certain cases in the Gynecologic Clinic at the University Hospital.

#### CORPUS LUTEUM ORGANOTHERAPY FOR THE ARTIFICIAL MENOPAUSE

The distressing symptoms accompanying the artificial menopause that so frequently follows the removal of both ovaries have previously been dwelt upon. That the ovaries elaborate an internal secretion, and that the removal of these organs is the cause of the artificial menopause, is now a well-established fact. By experimental work it has been determined that this secretion originates in the corpus luteum (Fränkel<sup>2</sup> and many others). The ovarian secretion appears to act in conjunction with the secretion of other ductless glands. The removal of the corpora lutea in many cases produces general disturbances, such as proliferation of the cells of the islands of Langerhans (Rebaudi<sup>3</sup>), changes in the hypophysis (Giorgi<sup>4</sup>), disturbances of the thyroid (Rogers<sup>5</sup>), and many other widely divergent results. Collard and Huard<sup>6</sup> state that because of the close relationship existing between the ovary and the thyroid it is advantageous to combine these two extracts.

<sup>1</sup> v. Toth: *Zent. f. Gyn.*, 1912, No. 2.

<sup>2</sup> Fränkel, L.: *Arch. f. Gyn.*, 1903, vol. lxxviii, p. 438.

<sup>3</sup> Rebaudi: *Zent. f. Gyn.*, 1908, No. 41.

<sup>4</sup> Giorgi: *Ginecologia*, 1906, vol. iii, p. 725.

<sup>5</sup> Rogers, J.: *Jour. Amer. Med. Assoc.*, 1912, vol. lix, No. 9, p. 702.

<sup>6</sup> Collard and Huard: *Thèse de Paris (l'Obstetrique)*, 1912.

That the disturbances produced by the removal of both ovaries vary widely in different individuals is also certain; some patients suffer but little, whereas in others general nervous manifestations are marked. It would seem that, upon theoretic grounds, the administration of corpus luteum extract to those patients who have been deprived of their ovaries as a result of surgical intervention during their active sexual life should be of great benefit. Fränkel,<sup>1</sup> in 1910, published the results of an extensive series of experiments on this subject. In 90 per cent. of his cases the flushes and nervous symptoms of the artificial menopause were relieved. Burnam<sup>2</sup> has more recently reported equally good results. Mayo,<sup>3</sup> Clark,<sup>4</sup> Litzenberg,<sup>5</sup> Mainzer,<sup>6</sup> de Camboulas,<sup>7</sup> Drevet,<sup>8</sup> Hill,<sup>9</sup> and Godart<sup>10</sup> have also reported good results with this preparation in this class of cases. No serious ill effects follow the administration of corpus luteum extract by mouth, but Villemin,<sup>11</sup> Ferroni,<sup>12</sup> Lambert,<sup>13</sup> and others have shown that when given intravenously toxic effects may be produced upon animals. Burnam<sup>14</sup> has employed finely chopped-up raw luteum of the sow fed as a salad or the dried products, and states that the latter is equally as effective provided it is freshly prepared. He states that patients vary widely in their susceptibility to the dried extract, and that the actual dose can be determined only by experimentation. Some patients complain of the taste of the tablets, and occasionally a slight gastric disturbance is produced. With these exceptions, Burnam<sup>15</sup> has noted no ill effects, even from enormous doses, while the beneficial results have been marked. In those patients who are relieved, the effect is generally noted in a few days. In some cases the administration of corpus luteum extract appears to have no effect. The extract is an expensive preparation, and for this reason its long-continued administration is, in many patients, impracticable. The author's experience with this preparation has been too limited to draw accurate conclusions from. Some cases appear to have been markedly benefited, while in other instances little or no result has been apparent. Whether

<sup>1</sup> Fränkel: Arch. f. Gyn., 1910, vol. xci, p. 752.

<sup>2</sup> Burnam, C. F.: Jour. Amer. Med. Assoc., August 31, 1912, p. 698.

<sup>3</sup> Mayo, C.: Jour. Amer. Med. Assoc., 1912, vol. lix, No. 9, p. 702.

<sup>4</sup> Clark, S. M. D.: *Ibid.*, p. 702.

<sup>5</sup> Litzenberg, J. C.: *Ibid.*, p. 703.

<sup>6</sup> Mainzer: Deut. med. Woch., 1896, No. 12, p. 188.

<sup>7</sup> de Camboulas, B.: Le Sue Ovarien, Paris, 1898.

<sup>8</sup> Drevet: Thèse de Paris, 1907.

<sup>9</sup> Hill, C. A.: Surg., Gyn., and Obst., 1910, vol. x, p. 58.

<sup>10</sup> Godart: Thèse de Paris, 1908.

<sup>11</sup> Villemin: Thèse de Lyons.

<sup>12</sup> Ferroni, E.: Ann. di ostet. Milano, 1907, vol. i, p. 405.

<sup>13</sup> Lambert: Compt. rend. Soc. de Biol., 1907, vol. lxii, p. 18.

<sup>14</sup> Burnam, C. F.: Jour. Amer. Med. Assoc., August 31, 1912, p. 698.

<sup>15</sup> Burnam, C. F.: *Loc. cit.*



in the latter cases the negative results have been due to improper dosage or faulty extract it is difficult to determine. The author has never seen ill effects follow its use, and believes that when given by mouth, the preparation is practically harmless, although Krusen<sup>1</sup> states that in one instance he was compelled to reduce the dose because of cardiac palpitation following its use. The preparation employed should be a carefully made desiccated extract, and should be guarded against exposure to extreme heat or cold. Fluidextracts, whether aqueous or glycerinated, have not proved entirely satisfactory. From a study of the literature on this subject it would appear that the results have been sufficiently satisfactory to warrant the employment of this preparation in all cases exhibiting distressing symptoms of the artificial menopause.

Another therapeutic indication for lutein is in pregnant women, on whom operations upon the adnexa have been performed, and miscarriage is feared. This is especially true during the early months of pregnancy, as the corpus luteum has been shown experimentally to have a definite physiologic action upon the fecundated ovum. As a general rule, the extract should be given in gradually increasing doses.

#### POST-OPERATIVE CARE OF CASES OF PELVIC INFLAMMATORY DISEASE

As a safeguard against peritonitis, it is advisable to place all patients in the Fowler position for the first twenty-four or forty-eight hours following operation, or even longer if distention or fever is present. A great advantage of the Fowler position is that if adhesions result, they occur in a position similar to that assumed by the patient while upon her feet, and are not, therefore, so prone to cause subsequent distress. If the bed is well padded and adjusted to the proportions of the individual patient, the Fowler position does not usually cause inconvenience. If, after operation, areas of infection still persist in the lower genital tract, these should receive appropriate treatment. This is especially important in cases in which conservative operations have been performed. Failure in this detail and reinfection from below doubtless account for a definite proportion of operative failures.

<sup>1</sup> Krusen, W.: *Amer. Jour. Obst.*, October, 1912, p. 524.



## CHAPTER XIV

### UNUSUAL MANIFESTATIONS AND REMOTE COMPLICATIONS OF PELVIC INFLAMMATORY DISEASE

#### RUPTURE OF INFLAMMATORY UTERINE ADNEXA INTO THE PERITONEAL CAVITY

In a previous chapter the possibility of rupture of inflammatory tubal collections of fluid into the intestine, bladder, uterus, peritoneal cavity, or even through the abdominal wall was mentioned. Rupture or perforation of an adherent pyosalpinx into the rectum is not infrequent, and into the bladder or upper intestine is more rare. Rupture into the peritoneal cavity seldom occurs, and is the form of accident described in the following pages.

Rupture may occur spontaneously, or may be the result of direct violence, as from a kick or blow on the vulva, perineum, or lower abdomen. Mann<sup>1</sup> and others report cases in which the injury is supposed to have occurred to patients during their transportation to a hospital for treatment for pelvic inflammatory disease. At least one reported case was caused by the trauma incident to a curetage, while Fisher<sup>2</sup> reports a case in which rupture was apparently caused by the application of electricity to the lower abdomen. The Fallopian tubes, situated as they are in the pelvis, and surrounded laterally by the bony prominences, and protected from below by the strong perineum and the intervening structures, and from above by the thick layer of intestines and the abdominal wall, make rupture resulting from accidental traumatism of rare occurrence. Rupture caused by ill-advised or too vigorous bimanual examination has occurred in a number of cases, as shown by the reports of Legueu<sup>3</sup> and Martin.<sup>4</sup> Violent coitus may, in exceptional cases, result in the bursting of a pyosalpinx. Inflamed tubal collections may also rupture as a result of manipulations performed for the purpose of inducing abortion. Chavassa<sup>5</sup> recently reported a case of this kind, and Mary<sup>6</sup> has encountered three

<sup>1</sup> Mann: Amer. Jour. Obst., 1907, vol. lvi, p. 461.

<sup>2</sup> Fisher, J. M.: Trans. Phila. Obst. Soc., June 1, 1911.

<sup>3</sup> Legueu: Compt. rend. Soc. Obst. de Gyn. et de Pæd. de Paris, 1903, vol. v, p. 83.

<sup>4</sup> Martin: Rev. prat. d'obst. et de Pæd. de Paris, 1906, vol. xix, p. 230.

<sup>5</sup> Chavassa, M.: Bull. et de la Soc. Anat. de Paris, January 5, 1910, p. 79.

<sup>6</sup> Mary, A.: "Sur un cas de rupture de pyosalpinx pendant l'accouchement," Thèse de Paris, 1908.

similar cases in lying-in women. All died. Puerperal infection was the diagnosis made in these cases. Lejars<sup>1</sup> states that the flaring up of a previously chronic process may lead to rupture. Galliard and Chaput<sup>2</sup> have reported a case in which rupture occurred in a patient convalescing from typhoid fever. Latzko<sup>3</sup> and Cotte and Chaliér<sup>4</sup> have each reported a case of ruptured abscess in an ovary. Lejars<sup>5</sup> has also encountered two cases in which the tube was perforated and had become gangrenous, the conditions resembling exactly those seen in a gangrenous appendix. The peritonitis following these cases was of an unusually severe type. In Brickner's<sup>6</sup> case rupture occurred while the patient was straining at stool. A number of cases have been reported in which rupture occurred during pregnancy or labor. It is probable that if pelvic inflammatory disease did not usually cause sterility, rupture would be much more frequent, as the uterus slowly rising out of the pelvis, to which an inflammatory tube is densely adherent, causes traction on the tube, a drawing out and thinning of this structure, which, if it does not itself finally cause rupture, produces in the tube a condition in which a small amount of trauma may produce this lesion. Indeed, Gonsolin<sup>7</sup> states that under such circumstances tubes may even rupture as a result of traction in which both ends are patulous. Labor in itself may cause rupture.

Spontaneous rupture is rare. Bonney,<sup>8</sup> in 1909, reported a case of rupture of a pyosalpinx, and carefully reviewed 44 other authentic cases collected from various sources. This writer<sup>9</sup> states that he wrote to 50 surgeons, asking for reports of their experience with cases of this character. Of the 40 who replied, but 14 had seen the condition. Bovée,<sup>10</sup> in 1910, collected statistics from 55 cases, and submitted the history of an additional case which occurred in his own practice. In the majority of the reported cases there was no assignable cause for the rupture. In the minority of them such exciting causes as straining, lifting, the muscular efforts incident to labor, traumatism inflicted during coitus, and the use of violent purgatives, seem to have been operative. In some cases rupture evidently follows a fresh puerperal infection superimposed on an old inflamma-

<sup>1</sup> Lejars, F.: *Semaine Médicale*, Paris, April 12, 1911, p. 169.

<sup>2</sup> Galliard and Chaput: *Semaine Médicale*, 1909, p. 538.

<sup>3</sup> Latzko: *Geb. u. Gyn. Gesellschaft in Wien*, March 17, 1908.

<sup>4</sup> Cotte and Chaliér: *Rev. de Gyn. et de Chir. Abdom.*, 1907, vol. xi, p. 579.

<sup>5</sup> Lejars, F.: *Semaine Médicale*, Paris, April 12, 1911, p. 169.

<sup>6</sup> Brickner, W. M.: *Surg., Gyn., and Obst.*, May, 1912, p. 475.

<sup>7</sup> Gonsolin: *Thèse de Lyons*; also quoted by Lamoreaux: *Les Arch. de Gen. Chir.*, January, 1910.

<sup>8</sup> Bonney, C. W.: *Surg., Gyn., and Obst.*, 1909, vol. ix, p. 542.

<sup>9</sup> Bonney, C. W.: *Loc. cit.*

<sup>10</sup> Bovée: *Surg., Gyn., and Obst.*, 1910, vol. x, p. 405.

tory process. Rupture usually takes place in the ampulla of the tube, although Mary<sup>1</sup> reports a case in which the rent was found in the isthmus. In the cases of inflammatory disease of the uterine adnexa in which rupture occurs the primary condition is almost invariably a pyosalpinx. No rule can be formulated as to the size of the pyosalpinx in which rupture is most likely to occur—many of the reported cases have been small. Naturally those specimens in which the walls are thin and friable are more prone to this accident than are those in which the walls are thick and fibrous. Adhesions in some cases probably play an important part. Recent attacks of pelvic peritonitis, by augmenting the contents of the tube and thereby adding to the intratubal pressure, and by inflammatory changes in the tubal walls, increase to a great extent the likelihood of rupture.

**Symptoms.**—The symptoms arising from rupture of a pyosalpinx or other inflammatory lesion of the adnexa naturally vary widely. If the rupture takes place into the peritoneal cavity, grave symptoms usually result. The severity of the symptoms depends largely upon the grade of the infection, and perhaps to a lesser degree upon the resistant powers of the individual patient. It is quite probable that when the tubal contents have become sterile, rupture of that structure, with escape of its contents into the peritoneal cavity, may occur, with little or no ill effects to the patient; indeed, the leakage from the end of a tube the seat of a salpingitis is but a mild form of an almost analogous condition. In 29 of the 31 cases analyzed by Bonney<sup>2</sup> in which rupture occurred into the peritoneal cavity, and in which an accurate history of the attack was procurable, the onset was abrupt and violent, and the evolution of the symptoms rapid. The fact that rupture is particularly likely to occur during an acute exacerbation when the infecting organisms in the inflammatory lesion are active, makes the prognosis in these cases much less favorable. Sudden sharp pain in the lower abdomen, at first most acute over the seat of the lesion, followed by more or less marked collapse and the rapid development of diffuse peritonitis, constituted the symptom-complex. In Lamouroux's<sup>3</sup> series the onset was sudden in every case, and was usually accompanied by violent pain over the seat of rupture, which soon became general, involving the lower abdomen, and in many cases the entire peritoneal cavity. Nausea and vomiting frequently occurred. The temperature is often normal or subnormal for a few hours, and the

<sup>1</sup> Mary, A.: "Sur un cas de rupture de pyosalpinx pendant l'accouchement," Thèse de Paris, 1908.

<sup>2</sup> Bonney, C. W.: Surg., Gyn., and Obst., 1909, vol. ix, p. 542.

<sup>3</sup> Lamouroux, H. G. A.: Arch. Gén. de Chir., Paris, September 25, 1912, p. 1005.

pulse rapid and weak; pallor, sweating, and other symptoms suggestive of an internal hemorrhage are frequently early symptoms. The temperature soon rises, and other evidences of peritonitis rapidly become manifest. The disproportion between the pulse-rate and temperature in the very early stage is a suggestive sign.

In those cases in which rupture of the tube has taken place during labor the symptoms have usually been attributed to ordinary puerperal infection. Fabricius<sup>1</sup> case is, however, an exception, and prompt operation resulted in the saving of the life of his patient.

**Diagnosis.**—If the surgeon has made a pelvic examination of the case before rupture has taken place, and is, therefore, familiar with the size and shape of the diseased adnexa, a comparison between the collapsed tube and its former turgid condition will be of the greatest value in aiding him in arriving at a correct diagnosis. The condition must be differentiated from the acute exacerbation of a chronic pelvic inflammatory lesion; from torsion or rupture of an ovarian neoplasm; from torsion of an inflamed tube and ovary; from acute appendicitis with perforation; and from ruptured ectopic pregnancy and other acute conditions of the lower abdomen that may cause peritonitis. From the first of these lesions rupture may be distinguished by the sharp, localized pain, the diffuse character of the infection, and by the severity of the symptoms. The clinical picture presented by the rupture or acute torsion of an ovarian cyst is very similar to that of rupture of a pyosalpinx, but the absence of gonorrhea in the lower genital tract, the history of the case, and, lastly, the pelvic examination, should be sufficient to enable the surgeon to arrive at a correct diagnosis. Torsion of an inflamed uterine appendage is so rare a condition that it need hardly be taken into consideration in the ordinary case. In this condition, however, the symptoms are not always so acute; the picture of diffuse peritonitis is, as a rule, absent, or occurs somewhat later, and pelvic examination will reveal an enlarged, tense mass, whereas in the case of rupture, the cyst-sac is collapsed and reduced in size. The two conditions are, however, in some cases, indistinguishable. A number of recorded cases of spontaneous rupture of a pyosalpinx have been mistaken for appendicitis or a ruptured tubal pregnancy, and the correct diagnosis has been made only after the abdomen has been opened. Lejars<sup>2</sup> strongly emphasizes the necessity for bearing in mind the possibility of rupture of an inflamed uterine adnexa when confronted with menacing peritonitis of unknown origin. The anamnesis of the

<sup>1</sup> Fabricius: *Wien. klin. Woch.*, 1897, vol. x, p. 1056.

<sup>2</sup> Lejars, F.: *Semaine Médicale*, Paris, April 12, 1911, p. 169.

case often shows acute flaring up of an infectious process just before a slight contusion occurs that induces the rupture. However, the history of the case and a careful pelvic examination, if necessary, made under an anesthetic, should in most instances establish the differential diagnosis between these two lesions. From ruptured tubal pregnancy torsion may be distinguished by the presence, in the latter, of evidences of pelvic inflammatory disease, the hyperpyrexia, the symptoms of peritonitis, and the absence, in many cases, of the signs indicative of internal hemorrhage. Fortunately, the treatment of all the conditions for which spontaneous rupture is likely to be mistaken is the same, viz., operation. In Bonney's<sup>1</sup> series of cases sufficient data were not obtainable positively to identify the variety of the infecting micro-organism in the majority of the cases. He states, however, that a large proportion of them were of gonorrheal origin.

In a study of the literature of 91 cases, Brickner<sup>2</sup> found 11 to be clinically of gonorrheal origin. Many reports are entirely lacking on this point, but it seems probable that gonorrheal pus-tubes are quite as likely to rupture as are those due to other varieties of infection. The age of the patients varies quite widely, rupture naturally occurring most frequently at the period when active pelvic peritonitis is most frequent. Owing to the insufficient data supplied in many of the reports, nothing definite can be determined regarding the duration of the pyosalpinx and the number of acute attacks that have occurred prior to the rupture, although recent exacerbations undoubtedly exert a predisposing influence on this condition.

Menge and others have established the fact that in a definite proportion of cases of gonorrheal pyosalpinges the tubal contents do not contain gonococci, or if these microorganisms are present, they possess only a limited degree of virulence. The severe symptoms that usually follow the rupture of an inflammatory tube is a strong argument in favor of the presence of a mixed infection in these cases. Another explanation is that the rupture frequently occurs during an exacerbation of a preëxisting pelvic inflammatory disease, a period when the microorganisms present in the tubal contents are likely to be especially virulent. During the quiescent period inflammatory lesions of the tube are not enlarging, but during acute attacks more pus is frequently being formed within the tube, and, as a consequence, the intratubal tension is increased and rupture at this period is, therefore, more likely to take place. Subsequent to the rupture gonococci have, in many cases, been demonstrated in the peritoneal exudate, but they

<sup>1</sup> Bonney, C. W.: *Surg., Gyn., and Obst.*, 1909, vol. ix, p. 542.

<sup>2</sup> Brickner, W. M.: *Surg., Gyn., and Obst.*, May, 1912, p. 475.

are seldom found in pure culture, and are usually associated with other pathogenic organisms. Rupture probably occurs almost as frequently on one side as on the other, although Brickner<sup>1</sup> states that in 53 cases rupture occurred 33 times in the right tube and 23 times in the left. The fact that inflammatory tubal lesions are slightly more frequent on the right than on the left must be taken into consideration. The size and location of the rent also vary, but usually occur in the ampullæ, and in some cases the rupture merely consists in the tearing open of the abdominal ostium, as in the cases recorded by Baisch,<sup>2</sup> both of which were of puerperal origin, while in others the rupture has been found in the tubal wall. As in many cases of pelvic peritonitis, the opposite tube is often diseased.

**Prognosis.**—The prognosis is naturally dependent largely upon the variety and virulence of the infecting microorganism. Bonney<sup>3</sup> states that of the 45 cases studied by him, recovery took place in 23 and death occurred in the remaining 22—a mortality of 48.8 per cent.; while in Bovée's<sup>4</sup> series of 56 cases there was a mortality of 58 per cent., 32 having died either with or without an operation. In Lamouroux's<sup>5</sup> series of 27 cases 9 patients succumbed. In 30 of Bonney's<sup>6</sup> cases it was possible to determine the time that elapsed between the rupture and the operation. Of 20 patients operated upon during the first twelve hours, 14 recovered and 6 died. One patient, operated upon at the end of twenty-four hours, recovered. Of 5 operated upon at the expiration of forty-eight hours, 4 died and 1 recovered. Of 4 patients operated upon between the fourth and the tenth day, 3 recovered and 1 died. An analysis of the cases in which operation was refused or contraindicated by the gravity of the patient's condition shows that 1 patient died thirty-six hours after the presumable time of rupture; 1, forty-eight hours afterward; 1, seventy-two hours afterward; 2, ninety-six hours afterward; and 2 at the end of two weeks. Of the remaining 8 patients, 3 of whom recovered and 5 of whom died, nothing could be learned either with reference to the time elapsing between the performance of the operation or the period intervening between the beginning of the attack and its fatal termination. All the 18 cases recorded by Bovée<sup>7</sup> which were not operated upon died. The length of time they survived after rupture varied from a few hours to three and

<sup>1</sup> Brickner, W. M.: Surg., Gyn., and Obst., May, 1912, p. 475.

<sup>2</sup> Baisch: Münch. med. Woch., September 19, 1911, vol. lviii, p. 1994.

<sup>3</sup> Bonney, C. W.: Surg., Gyn., and Obst., 1909, vol. ix, p. 542.

<sup>4</sup> Bovée: Surg., Gyn., and Obst., 1910, vol. x, p. 405.

<sup>5</sup> Lamouroux, H. G. A.: Arch. Gén. de Chir., Paris, September 25, 1912, p. 1005.

<sup>6</sup> Bonney, C. W.: Surg., Gyn., and Obst., 1909, vol. ix, p. 542.

<sup>7</sup> Bovée: Surg., Gyn., and Obst., 1910, vol. x, p. 405.



one-half months. Two patients admitted to the hospital on the fourteenth day after rupture lived respectively four and twelve days. Of the 12 others that died without operation, and of which data were obtainable, the average number of hours that they survived was fifty-nine. Bovée<sup>1</sup> and Bonney<sup>2</sup> reiterate the statement previously made by Boldt<sup>3</sup> that there is not a single case on record in which recovery took place without operative intervention. In this connection, however, it should be remembered that the cases in which recovery would be likely to occur without operation, *i. e.*, those in which the tubal contents were sterile or in which the microorganisms were attenuated, and in which, as a consequence, the symptoms would be of a milder grade, are the very ones in which a positive diagnosis of rupture would be extremely difficult to make. It, therefore, seems likely that rupture may, in some instances, take place and be mistaken for a simple exacerbation of an old pelvic lesion and not cause a fatal termination.

**Treatment.**—All cases of rupture in which the diagnosis is possible should be subjected to immediate operation. The type of operation indicated will naturally depend upon the extent and variety of the lesions encountered.

The following is Bovée's<sup>4</sup> table of cases of ruptured inflammatory adnexa, to which has been added a synopsis of additional cases that occurred since his excellent report was published, including two occurring in the Gynecologic Department of the University Hospital, neither of which has previously been reported.

Martin<sup>5</sup> reports briefly 2 cases of spontaneous rupture of a hydrosalpinx into the abdominal cavity, and 11 cases in which rupture occurred during bimanual examination. Huras<sup>6</sup> reports 6 cases from Pozzi's clinic. A further contribution to the subject of rupture of suppurative adnexal lesions may be found in Lamouroux's paper in the Thèse de Paris, 1912, which we have been unable to obtain at the time of going to press.

<sup>1</sup> Bovée: *Loc. cit.*

<sup>2</sup> Bonney, C. W.: *Surg., Gyn., and Obst.*, 1909, vol. ix, p. 542.

<sup>3</sup> Boldt: *Amer. Jour. Obst.*, 1889, vol. xxii, p. 262.

<sup>4</sup> Bovée: *Surg., Gyn., and Obst.*, 1910, vol. x, p. 405.

<sup>5</sup> Martin: *Rev. prat. d'obst. et de pædiat.*, Paris, 1906, vol. xix, p. 230.

<sup>6</sup> Huras, H.: *Mensuelles d'obst. et de gyn.*, January, 1912.



# TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
1. Chipault (Bull. Soc. Anat. de Par., 1861, vol. xxxvi, p. 149).	Acute general peritonitis.	No operation. Autopsy findings: Right tube distended with pus, left tube contained some pus and had a small rupture; cancer of uterine cervix was advanced.	Death.
2. MacLaren (see Bonney).	Acute general peritonitis.	Second day of attack, incision, with flushing and drainage. Autopsy findings: A ruptured, distended pus-tube and general peritonitis.	Death two days after operation.
3. Abnagro (Bull. Soc. Anat. de Par., 1862, vol. xxxvii, p. 171).	Acute general peritonitis.	No operation. Autopsy findings: Pus in abdominal cavity; right tube enormously distended by pus and has a rupture 4 cm. long; left tube also distended, but not ruptured.	Death second day in hospital.
4. Rochet (Jour. d'accouch., Liège, 1892, vol. xiii, p. 195).	Acute general peritonitis.	Five days after admission to hospital abdominal and vaginal sections were made, drainage employed. Autopsy findings: General purulent peritonitis, with tubes enlarged and the right ruptured and containing pus.	Death promptly followed operation.
5. Wood, C. S. (Trans. N. Y. Med. Jour., 1889).	Acute general peritonitis.	Operation during the first twenty-four hours by W. Gill Wylie, during collapse; abdominal section; right pyosalpinx had ruptured.	Recovery.
6. Janeway, E. G. (N. Y. Med. Jour., 1880, vol. xxxii, p. 522).	Admission on fourteenth day of attack of peritonitis.	No operation. Autopsy findings: General peritonitis, patches of fibrous lymph on liver, intestine, and uterus; 12 ounces of pus in pelvis; right pus-tube ruptured; left pyosalpinx unruptured.	Death four days after admission.
7. Wilcoot (Clinique, Brux., 1893, vol. vii, p. 529).	Ill with the attack of pelvic peritonitis fourteen days before admission.	No operation. Autopsy findings: Pus pocket in inferior right lobe of lung; pus very abundant in peritoneal cavity; intestinal loops covered by fibrous, thick, and very adherent exudate; circular rupture in left tube 2 cm. in diameter.	Died twelve days after admission to hospital.
8. Lequeu (Compt. rend. Soc. Obst. de gynéc. et de pæd. de Par., May, 1903, vol. v).	Acute general peritonitis.	Operation was done at once. Ruptured by examination, and abdominal section one and one-half hours after. Rupture found.	Recovery.
9. Leguen: <i>Ibid.</i>	Acute general peritonitis.	Ruptured by examination. Severe shock. Pain, vomiting, weak rapid pulse, and tendency toward syncope. Symptoms of internal hemorrhage; at operation a ruptured pyosalpinx was found and free pus. Salpingectomy. Operation one hour after rupture.	Recovery.
10. Peuch (Compt. rend. soc. de biol., Paris, 1860, 34 s., vol. i, p. 27).	Subacute peritonitis.	No operation. Autopsy findings: Cystic left ovary; inflammation and abscess of both tubes, one ruptured, and abdominal cavity deluged.	Died three and one-half months after admission to hospital.

11. Corne (Bull. Soc. Anat. de Par., 1880, vol. xlii, p. 37).	Onset three days before admission.	Autopsy findings: Ruptured left tube and general acute peritonitis; intestinal coils adherent.	Died three days after admission.
12. Proust and Mascarenhas (Bull. et mem. Soc. Anat. de Par., 1909, vol. lxxiv, p. 294; Annal. d. Gynec. et de Obst., September, 9109).	Admitted on third day of attack.	On admission to the hospital patient was vomiting, temperature 38° C., pulse 120 and of bad character; a tender mass could be felt in Douglas' cul-de-sac. Operated upon immediately after admission. Large quantity of fetid, purulent fluid escaped from the abdominal incision; rupture found in lower posterior surface of a right pus-tube; the latter removed; left tube normal; drainage.	Recovery.
13. Fabricius (Wien. klin. Woch., 1897, vol. x, p. 1056).	Acute, ruptured during labor.	Prompt operation with removal of the ruptured tube.	Recovery.
14. Boldt (Amer. Jour. Obst., 1889, vol. xxii, p. 262).	Acute general peritonitis.	Operation done on the sixth day; pus found in peritoneal cavity; intestines matted together; both tubes ruptured.	Death in sixty hours.
15. Boldt: <i>Ibid.</i>	Acute general peritonitis.	On second day abdomen was opened and right tube found ruptured.	Died.
16. Boldt: <i>Ibid.</i>	Acute peritonitis.	Operation a few hours after rupture of right tube; perforation 2 cm. in diameter, free fluid in peritoneal cavity, and the peritoneum considerably congested.	Recovery.
17. Boldt: <i>Ibid.</i>	Three days' duration.	Operation refused. Autopsy findings: Peritoneal cavity full of pus, intestines matted, double pyosalpinx, the right ruptured.	Died.
18. Boldt: <i>Ibid.</i>	Acute peritonitis.	Operated upon three hours after onset and in collapse, free fluid in the peritoneal cavity, and the left pus-tube ruptured.	Recovery.
19. Boldt: <i>Ibid.</i>	Acute peritonitis.	Operation deferred too long—because of apparent improvement, operation was not done at all. No autopsy. The diagnosis is vouched for by Boldt.	Death in thirty-six hours.
20. 21. Brin, H. (Arch. med. d'Angers, 1900, vol. iv, p. 556).	Both acute peritonitis.	Autopsies disclosed ruptured pus-tubes and acute general peritonitis.	Both died.
22. Cotte and Chaliel (Rev. de gyn. et de chir. abd., 1907, vol. xi, p. 579).	Admitted two days after beginning of attack of acute perforative peritonitis.	Operation a few hours after admission. Peritoneal cavity found full of seropurulent fluid, intestines not adherent. Nothing but insertion of drainage-tube into pelvis was done. Autopsy, perforation in a right pyosalpinx large enough to admit little finger.	Died forty hours after operation.
23. Cotte and Chaliel: <i>Ibid.</i>	Acute general peritonitis of two days' duration.	Operation day of admission; free fluid in peritoneal cavity and pus in pelvis. Left pyosalpinx found ruptured, collapsed, and nearly empty; perforation in middle of a gangrenous area near ampulla; appendage removed and drainage through abdomen and vagina.	Death three days after operation.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(Continued)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
24. Cotte and Chaher: <i>Ibid.</i>	Advanced general peritonitis.	No history obtainable, condition very grave, precluding operation. Autopsy showed rupture of right pyosalpinx.	Death a few hours after admission.
25. Cotte and Chaher: <i>Ibid.</i>	Admitted sixth day of attack of general peritonitis.	Operation a few hours after admission, free fluid in peritoneal cavity and pus in pelvis; perforation $\frac{1}{2}$ cm. long found in anterior surface of a right pyosalpinx; tube not removed; abdominal and vaginal drainage; condition precarious.	Recovery
26. Cotte and Chaher: <i>Ibid.</i>	Admitted on third day of attack of general peritonitis.	Operation one hour after admission; large quantity purulent fluid in peritoneal cavity. Two perforations found in large right tubo-ovarian abscess, one as large as a franc piece.	Died twenty-four hours after operation.
27. Bullitt (Louisville Jour. Med. and Surg., 1900-01, vol. vii, p. 471).	Acute general peritonitis. Admission to hospital on second day.	Admitted for operation for chronic salpingitis and pelvic peritonitis—no urgent symptoms, though abdomen distended and painful; operation deferred, suddenly became worse; died forty-eight hours after admission. Autopsy revealed general peritonitis and a large perforation in a left pyosalpinx.	Death.
28. Cardedge (Louisville Jour. Med. and Surg., 1900-01, vol. vii, p. 472).	Acute general peritonitis.	Moribund when first seen; perforation of left tube found as cause of peritonitis at operation.	Death.
29. Vance: <i>Ibid.</i> , 1900-01, vol. vii, p. 472).	Acute peritonitis. Three hours.	Admitted to hospital for minor gynecologic treatment; next day suddenly became shocked and abdomen opened in three hours. A ruptured pus-tube was found.	Recovery.
30. Abell: <i>Ibid.</i> , 1906-07, vol. xiii, p. 403.	Acute peritonitis, third day.	Operation third day of illness, a ruptured right pyosalpinx found.	Recovery.
31. Anderson: <i>Ibid.</i> , p. 153.	Acute peritonitis.	Operation. Both tubes contained pus and were ruptured. General peritonitis; patient was living at time of report, which was made on day of operation.	Not known.
32. Leith (African Med. Rec., Cape Town, 1907, vol. v, p. 230).	Acute general peritonitis, first day.	Operation first day of attack, parietal peritoneum thickened and congested and lymph on intestines; left pyosalpinx ruptured.	Recovery.

33. Young (Boston Med. and Surg. Jour., 1905, vol. i, p. 551).	Acute general peritonitis, third day.	Admitted third day of attack of pelvic suppurative inflammation. The following day had excruciating abdominal pain, vomiting, collapse, and rapidly developing peritonitis. Operation without delay; pus found in all parts of peritoneal cavity; a ruptured pyosalpinx was found and excised.	Recovery.
34. Fenwick (Lancet, London, 1897, vol. ii, p. 1385).	General suppurative peritonitis.	Died two days after admission and without operation. Autopsy showed general suppurative peritonitis, evidence of old pelvic inflammation, and a ruptured pus-tube.	Death.
35. Oleson (Chicago Med. Rec., 1894, vol. vi, p. 324).	Acute general suppurative peritonitis. Fifth day.	Died five days after labor, at which time pus-tube probably ruptured. Autopsy showed a pus-tube ruptured near fimbriated end and general acute suppurative peritonitis; rapid labor at eight months.	Death.
36. Oleson: <i>Ibid.</i>	Same as in 35.	Rapid and sudden delivery before arrival of obstetrician in ward; two days later chill and temperature of 103.2° F.; died five days after labor. Autopsy findings the same as in Case 35.	Death.
37. Price, M. (Amer. Jour. Obst., 1889, vol. xxii, p. 925).	Acute suppurative and general peritonitis.	Operation fifteen days after apparent rupture of a pyosalpinx in a case of incomplete abortion; both tubes had ruptured.	Death.
38. Frank, Louis (Med. News, Philadelphia, June 1, 1895, vol. lxi, p. 609).	General acute suppurative peritonitis. Fourteen hours.	Admitted to hospital during an attack, and next morning was in collapse; laparotomy a few hours later; the patient died in nine hours. Autopsy revealed rupture of a right tubo-ovarian abscess.	Death.
39. Mann (Amer. Jour. Obst., 1907, vol. lvi, p. 461).	Acute general peritonitis. Twelve to sixteen hours.	Patient in hospital for pelvic suppuration. Sudden onset of alarming symptoms on second evening after; next morning operation showed right pus-tube ruptured an inch from fimbriae and general peritonitis.	Recovery.
40. Mann: <i>Ibid.</i>	Acute suppurative general peritonitis.	Two days after an examination by a physician, who diagnosed tubo-ovarian abscess, patient was suddenly attacked by illness and collapse promptly ensued. Operation done at once; a large tubo-ovarian abscess, ruptured, was found, the opening being the size of a ten-cent piece.	Recovery.
41. Cushing (see Bonney) (Surg., Gyn., and Obst., 1909, vol. ix, p. 542).	Acute suppurative peritonitis. First day.	Operation day of rupture of a tubo-ovarian abscess into peritoneal cavity.	Death.
42. Dudley (see Bonney).	Acute suppurative peritonitis. First day.	Operation a few hours after rupture of a pyosalpinx into peritoneal cavity; complicated by rupture of vermiform appendix.	Recovery.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(*Continued*)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
43. Findley (see Bonney).	Acute general suppurative peritonitis.	Induced criminal abortion, followed in three weeks by curetage of infection of uterus and appendages; three days later evidence of general peritonitis; operation refused and death four days later. Autopsy, double pus-tubes; the left contained a large perforation causing diffuse suppurative peritonitis.	Death.
44. 45. Gardner (see Bonney).	Pelvic peritonitis (?).	Two cases practically alike. Both admitted during attack. Operation: Both tubes found to be enormously distended with pus and one had ruptured contents free in peritoneal cavity. Neither had acute fulminating peritonitis.	Recovery in both cases.
46. Ingalls (see Bonney).	Acute suppurative peritonitis. First day.	Patient in hospital and treated for acute salpingitis. Late one afternoon found in collapse; abdominal distention rapidly followed. Operation in a few hours. A ruptured pyosalpinx removed; abdominal drainage.	Recovery.
47. Ingalls (see Bonney).	Acute suppurative peritonitis. Ninth hour.	Admitted to hospital six hours after rupture and three hours later operation. General peritonitis and a ruptured pyosalpinx removed. Vaginal and abdominal drainage; fever continued.	Death in three months.
48. MacMonagle (see Bonney).	Acute septic peritonitis. Fourth day.	Patient apparently ruptured pus-tube in labor and had acute septic peritonitis, dying on the fourth day. Autopsy, left tube had ruptured and discharged pus into peritoneal cavity.	Death.
49. MacMonagle (see Bonney).	Acute general suppurative peritonitis.	Young woman on whom an abortion had been attempted; acute peritonitis followed. Operation immediate, and right tube found ruptured.	Recovery.
50. Smith, A. L. (see Bonney).	Acute suppurative peritonitis. First day.	Patient seen one hour after rupture; operated on at once; pyosalpinx had ruptured in the middle and deluged peritoneal cavity.	Recovery.
51. 52. Webster (see Bonney).	Acute fulminating peritonitis. First day.	In both cases a pyosalpinx had ruptured into the general peritoneal cavity and gave rise to an acute fulminating peritonitis. Both made stormy recoveries. Operation done during first few hours.	Both recovered.

53. Bonney, C. W. (Surg., Gyn., and Obst., 1900, vol. ix, p. 542).	Acute peritonitis. Fifth hour.	Fifth	Suppurative inflammation of the appendages had probably existed three weeks before very alarming abdominal symptoms and apparent imminent death induced her removal to hospital at night and operation five hours after first alarming symptoms. An abundant outflow of seropurulent fluid from abdomen, intestines injected and distended; a partly collapsed right large pus-tube was found perforated. Appendix removed, peritoneal cavity flushed out, abdominal drainage.	Recovery.
54. Theillhaber, A. (Munch. med. Woch., 1905, vol. lii, p. 69).			This author, in an article of six pages on "The Pathology and Therapy of Chronic Salpingitis," merely mentions a case in which perforation was followed by an unsuccessful operation.	Death.
55. Mary, A. ("Sur un cas de rupture de pyosalpinx pendant l'accouchement," Thèse de Par., 1908).	Acute peritonitis. Sixth day.	Sixth	A girl of sixteen years died six days after labor. Following labor, temperature was never normal. Two days later a postpartum curettage was done, as the pulse was 125 and temperature 102.4° F. Autopsy revealed general peritonitis and a large right pyosalpinx ruptured in the isthmus of the tube.	Death.
56. Bovée (Surg., Gyn., and Obst., 1910, vol. x, p. 105).	Acute diffuse peritonitis.		Severe pain through iliac region during coitus; under observation from early in fourth day; symptoms of rupture on fifth day of illness; operation done a few hours later. Tube had ruptured and inundated the peritoneum with pus.	Death third day after operation.
57. Riesmeyer, L. T. (St. Louis Med. Rev., August 1, 1906, p. 101).	Subacute peritonitis. Second day.		History of pelvic inflammatory disease for two years prior to operation. Tube occluded and filled with blood and debris. Operation on second day following rupture.	Convalescence normal. Recovery.
58. Evans, T. G. C., and Coombe, R. (Lancet, September 8, 1906, p. 654).	Acute peritonitis.		Age thirty-nine, nullipara. History suggestive of pelvic inflammatory disease. Frequent attacks of pelvic pain. Sudden onset of sharp pain, followed by the appearance of the symptoms of peritonitis. Temperature, 105° F.; pulse, 150-160. Left tube had been converted into a pyosalpinx and was ruptured. Case complicated by the presence of an ovarian cyst. Operation, left salpingo-oophorocystectomy. Drainage. Recovery.	Recovery.
59. Rue (Rev. mens. de gyn. d'obst. et. pédiat., Paris, 1908, vol. iii, p. 374).	Acute peritonitis.		Rupture accompanied by severe pain in lower abdomen, worse on affected side. Symptoms somewhat similar to appendicitis with perforation.	Recovery.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(Continued)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
60. Korte ("Weitere Berichte über die chirurgische Behandlung der diffusen eitrigen Bauchfellentzündung," Mitteilungen aus den Grenzgebieten der Medizin und der Chirurgie, 1897, vol. ii, p. 167).	Acute diffuse peritonitis.	Usual symptoms of peritonitis. Gonococci recovered from the peritoneal exudate. Operation.	Recovery.
61. Chevassu, M. (Bull. et mem. de la Soc. Anat. de Paris, January 5, 1910, p. 79).	Acute peritonitis.	Rupture, caused by attempt at criminal abortion; a long bone cannula was supposedly introduced into the uterus. This was followed in a few hours by fever, rapid weak pulse, and severe abdominal symptoms. Salpingo-oophorectomy. Drainage. Autopsy.	Death in five days.
62. Echols, C. M. (Surg., Gyn., and Obst., December, 1910, p. 589).	Subacute peritonitis. Third day.	Age twenty-five. Rupture due to violent coitus. Patient felt sharp pain in the pelvis and felt something "give way." This was followed by nausea and symptoms of peritonitis. When seen on the third day temperature was 100° F. and pulse 110. There was general tenderness, which was most marked over lower right quadrant. Slight tympanites was present. Diagnosis of appendicitis. Salpingectomy. Case probably of gonorrheal origin. Rupture occurred during the chronic stage.	Recovery.
63. Echols, C. M. (Surg., Gyn., and Obst., December, 1910, p. 589).	Acute peritonitis. First day.	Age thirty-two. During a severe muscular effort in attempting to save herself from a fall, patient felt something "give way," and a sharp pain over the seat of rupture. This was followed by a dull pain, which rapidly became severe. Nausea and vomiting were present. Eighteen hours later temperature was 102.2° F., pulse 115. Operation revealed bilateral pus-tubes, which were removed. The pelvic inflammatory disease was in the chronic stage when rupture occurred. The case was probably gonorrheal in origin.	Recovery.
64. Galliard et Chaput (Semaine Médicale, 1909, p. 538).	Acute peritonitis. First day.	Patient convalescing from typhoid fever, when she suddenly developed severe colic, vomiting, and tympanites, hyperpyrexia, and a pulse of 160. Perforation diagnosed. At operation right tube was swollen and perforated. It was removed.	Recovery.



65. Clark, J. G., and Norris, C. C.:	Acute peritonitis. Eighth hour.	The patient gave a history of pelvic inflammatory disease of two months' standing. She was thirty-two years of age. The patient had been given salines as a preliminary to operation. While at stool she was suddenly seized with a sharp pain in the left ovarian region, which doubled her up. At this time she was pale, the skin cold and clammy, and covered with perspiration. A few minutes later the radial pulse was almost imperceptible, and at operation, eight hours later, the left tube, which had been the seat of a large hydrosalpinx, was found ruptured on its superior surface in the region of the ampulla. Both tubes were diseased and removed.	Uncomplicated recovery.
66. Clark, J. G., and Norris, C. C.:	Acute peritonitis. Twenty-four hours.	Patient, thirty-one years of age, and gave a typical history of pelvic inflammatory disease. Rupture occurred while at school. No cathartics had been given, but patient was constipated and had been straining. Rupture was indicated by sudden sharp pain in left ovarian region, quickly followed by symptoms of collapse. Evidence of peritonitis developed in a few hours. Bilateral salpingectomy twenty-four hours later without drainage. Tube was ruptured in the ampulla on its posterior surface, the rent being longitudinal to the long axis of the tube and 2.5 cm. in length. The tube contained pus.	Uncomplicated recovery.
67. McGinn (Trans. Phila. Obst. Soc., June 1, 1911).	Acute general peritonitis.	Brought to hospital, diagnosed as a case of abortion. Rupture followed an examination by an intern. At this time symptoms strongly suggested ectopic pregnancy. Operation. Right tube ruptured in isthmus.	Death.
68. Nicholson, W. R.: <i>Ibid.</i>	Acute general peritonitis. Twelfth hour.	Patient admitted to Philadelphia General Hospital suffering from pelvic inflammatory disease. Numerous examinations by various interns, during one of which a left pyosalpinx was ruptured. Symptoms of general peritonitis rapidly developed. Operation twelve hours later.	Death.
69. Fisher, J. M.: <i>Ibid.</i>	Acute general peritonitis.	While treating a case of myoma of the uterus with electricity, one pole being against the cervix and the other over the lower abdomen, patient complained of severe pain, which was in a few hours followed by symptoms of general peritonitis. No operation. Autopsy showed rent in left pyosalpinx. Case occurred many years ago.	Death.
70. Grosse, M. A. (Gaz. med. de Nantes, No. 36, September 9, 1911; also Rev. mens. de gyn., d'obst. et pœd., June, 1911).	Acute general peritonitis.	Symptoms appeared during the puerperium and were due to the rupture of a pyosalpinx.	Death.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(Continued)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
71. Brickner, W. M. (Surg., Gyn. and Obst., May, 1912, p. 474).	Acute general peritonitis. Seventh hour.	Patient, aged nineteen. History of an attack of pelvic peritonitis four weeks after confinement. About a month later rupture occurred while at stool. This was accompanied by severe pain, nausea, and rapid rise of pulse-rate (140). The temperature rose in four hours to 104° F., accompanied by symptoms of purulent peritonitis. Operation seven hours after rupture, which was found to be on the superior aspect of the isthmus of the right tube. Salpingo-oophorectomy was performed with drainage. Cultures at time of operation were negative, but gonococci were subsequently found in the cervix and urethra.	Recovery.
72. Siebel, C. C. (Amer. Jour. Obst., September, 1912, p. 451; also Trans. N. Y. Acad. Med., April 18, 1912).	Acute general peritonitis. Fifth day.	Patient, aged thirty-five. Confined ten days prior to admission to hospital. On admission, temperature 104.4° F.; pulse, 120; respiration, 44. Patient died five days after admission, her temperature reaching as high as 106° F. Autopsy revealed a pyosalpinx in the left side, probably of some years' standing. The tube had become adherent to the mesentery, and had ruptured into it, distending the layers of the latter until finally the pus broke through, producing a diffuse peritonitis and death.	Death.
73. Cope, H. R. (Australas. Med. Gaz., 1912, vol. xxxi, p. 186).	Acute general peritonitis (?).	Patient, aged nineteen, was seized with violent abdominal pain, followed by collapse. Abdominal section was performed within a short time of the onset of symptoms. The right tube was found ruptured; much free pus was present, but no adhesions. Salpingectomy; drainage.	Recovery.
74. Carrell, W. B. (Texas State Jour. Med., April, 1912, p. 323).	Acute general peritonitis (?). Ninth hour.	Case 1.—Primipara, aged twenty-three. Gonorrhea two years ago, and symptoms of mild pelvic peritonitis at intervals since. While walking, patient was seized with sharp pain in right lower abdomen, which increased in severity and was accompanied by nausea and vomiting. A diagnosis of appendicitis was made. Operation nine hours after onset of attack. In the upper surface of the right tube was a rent, 0.5 inch in length. The tube, which had previously been an old pyosalpinx, was collapsed. On account of the bad condition of the patient the tube was not removed, but further opened and drained. Recovery after prolonged convalescence. A diplococcus, staphylococci, and streptococci were found in the discharge from the drainage tract.	Recovery.

75. Carrell, W. B.: *Ibid.*

Acute general peritonitis.  
Second day.

Case II.—Primipara, aged thirty. Pelvic examination three years ago revealed bilateral pus-tubes, at which time operation was refused. While driving, patient was seized with severe pain, which was followed by the usual symptoms of peritonitis. Operation forty-eight hours later showed one of the tubes collapsed and a perforation on its upper surface. Salpingectomy, drainage.

Death.

76. Caput (Revue de Gyn., 1906, vol. x, p. 963).

Acute general peritonitis.

Age, twenty. Cynatresia, with usual symptoms, becoming progressively worse. A large tumor, which proved to be a hematosalpinx, was found in the right iliac fossa. The right tube was the size of the fist, twisted six times, and perforated at one point. Free blood was present. The left tube was also the seat of a hematosalpinx and twisted five times. Bilateral salpingectomy.

Death.

77. Robb (Lancet, 1906, abstract from Lamouroux's paper; Arch. gén. de Chir., Paris, September 25, 1910, p. 1005).

Acute general peritonitis.

Onset two days after full-term labor. Temperature, 98° F.; pulse, 140. The abdomen was distended. Autopsy showed a general peritonitis due to rupture of a pyosalpinx.

Death.

78. Link, G. (Surg., Gyn., and Obst., December, 1910, p. 591; quoted by Lamouroux; Arch. gén. de Chir., Paris, September 25, 1910, p. 1005).

Peritonitis.

Usual symptoms of peritonitis (general).

Both recovery.

79. Halex (Bull. et mém. de la Soc. Anat. de Paris, 1907, vol. ix).

Acute general peritonitis.  
Second day.

Sudden onset, pain, tenderness, nausea, vomiting, and distention of the abdomen. Elevation of pulse and temperature. Operation forty-eight hours later. Drainage.

Death.

80. Poncet (Thèse de Consonlin, Lyons, 1908).

Acute general peritonitis.  
Second day

Case I.—Sudden onset. Symptoms of peritonitis. Operation forty-eight hours later.

Death.

81. Poncet: *Ibid.*

Acute general peritonitis.

Case II.—Sudden onset of symptoms. Salpingectomy, drainage.

Death.

82. Poncet: *Ibid.*

Acute general peritonitis (?).

Case III.—Sudden onset; violent pain in lower abdomen; vomiting; temperature, 38.8° C.; pulse, 130; distention. Laparotomy showed much free pus and a ruptured pyosalpinx. Abdominal and vaginal drainage.

Recovery.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(Continued)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
83. Poncet; <i>Ibid.</i>	Acute general peritonitis. First day.	Case IV.—Abrupt onset after purging. Temperature, 39° C.; pulse, 130; nausea and vomiting. Laparotomy showed much free pus and a ruptured inflammatory adnexal lesion. Drainage.	Death.
84. Lejars (Compt. rend. de la Soc. d'obstet., de gyn. et de ped., February, 1905).	Acute general peritonitis.	Abrupt onset, characterized by the development of symptoms of peritonitis. A large mass was present posterior to the uterus. At operation a ruptured tube was found and a resulting suppurating hematoma. Drainage.	Recovery.
85. Levass, P. (report by Delbet, P.; "Traité des suppurations pelviennes," abstract in Lamoignon's paper, Arch. gen. de Chir., September 25, 1912, p. 1005).	Acute general peritonitis.	Autopsy on a case dying of general peritonitis showed a ruptured pus-tube.	Death.
86. Tait, L. (Trans. London Obst. Soc., November 7, 1883).	Acute peritonitis.	Laparotomy for peritonitis showed the cause of the condition to be due to a ruptured pus-tube. Drainage.	Recovery.
87. Inlach (Liverpool Med. and Surg. Jour., 1886).	Acute general peritonitis.	Sudden onset, followed by symptoms of peritonitis. Pulse, 160. Patient in extremis. Operation. Tube was found ruptured and much free pus present in the peritoneal cavity.	Death.
88. Le Moniet (report by J. L. Faure; Bull. et mém. de la Soc. de Chir., July 3, 1912, n. s., vol. xxxviii, p. 967).	Peritonitis.	Sudden onset of severe pain in lower abdomen. No nausea or vomiting. General condition good. Tumor in the median line. Diagnosis, torsion of the pedicle of an ovarian cyst. At operation the uterus was found to be the seat of a myoma. A ruptured pyosalpinx was also present. Pannysteromyectomy and bilateral salpingo-oophorectomy. Drainage.	Recovery.
89. Gottschalk (Cent. f. Gyn., 1893, No. 22, p. 457).	Acute general peritonitis. Second day.	Symptoms pointing toward pelvic inflammatory disease for some time before. Sudden onset, with severe pain, which quickly became general over entire lower abdomen, followed by the usual symptoms of peritonitis. Operation forty-eight hours after rupture. Drainage.	Recovery.

90. Lejars (Compt. rend. de la Soc. d'obstet., de gyn. et de ped., February, 1905).	Acute general peritonitis.	Case I.—Sudden onset some days before; vomiting; pulse, 130, and temperature elevated; abdomen distended. Pain in right iliac fossa and mass in culdesac. Diagnosis of general peritonitis due to a ruptured appendiceal abscess was made. At operation free pus was found which contained streptococci. Drainage.	Death.
91. Lejars: <i>Ibid.</i>	Acute general peritonitis (?).	Case II.—Temperature, 37° C.; pulse, 130. Mass in the culdesac. At operation both tubes were found to have been converted into pyosalpings and one was ruptured; both were removed. In the pus from the peritoneal cavity colon bacilli were demonstrated. Drainage.	Recovery.
92. Lejars: <i>Ibid.</i>	Acute general peritonitis.	Case III.—Symptoms of peritonitis. Large mass presenting in the culdesac and extending upward into the abdomen. At operation large bilateral pyosalpings were found. Drainage.	Recovery.
93. Lejars (Semaine Médicale, April 12, 1911).	Acute general peritonitis.	Case IV.—Patient was seized with violent abdominal pain, followed by nausea; temperature, 38° C.; pulse, 120; abdomen was distended and tender. At operation both tubes were found to be the seat of pyosalpings and much free pus was present in the peritoneal cavity. Subpragvagineal hysterectomy; bilateral salpingo-oophorectomy. Drainage.	Recovery.
94. Lejars (Compt. rend. de la Soc. d'obstet., de gyn. et de ped., February, 1905).	Acute general peritonitis.	Case V.—Sudden onset. General symptoms of peritonitis; temperature, 39° C. The abdomen was distended and tender. A mass was present in the culdesac. The opening in the tube resembled a perforation such as is seen in an appendix. Drainage.	Result not stated.
95. Lejars (La Gyn., January, 1910, p. 70; also Compt. rend. de la Soc. d'obstet. et de gyn. et de ped. de Paris, 1906, vol. xi, p. 342).	Acute pelvic peritonitis (?).	Case VI.—Patient, aged forty. Presented the usual symptoms of chronic pelvic peritonitis. Acute attack, characterized by nausea, vomiting, chills, sharp pain in the lower right abdomen. Right salpingo-oophorectomy was performed. The right tube was found to have been the seat of a hydrosalpinx in which torsion and rupture had occurred. The tube was collapsed.	Result not stated.
96. Lamouroux, H. G. A. (Arch. gén. de Chir., 1910).	Peritonitis.	Case I.—Constipation, followed by violent pains in the lower abdomen, and vomiting. General condition moderately good; temperature, 39° C.; pulse, 110. Palpation showed induration in both vaginal fornices. At operation bilateral pus-tubes were found, one of which was ruptured. Panhysterectomy and bilateral salpingo-oophorectomy. Drainage.	Recovery.

TABLE OF CASES OF RUPTURED INFLAMMATORY ADNEXA—(Continued)

REPORTED BY	DURATION OR STAGE OF PERITONITIS	NOTES	RESULT
97. Lamouroux, H. G. A.: <i>Ibid.</i> , September 25, 1912, p. 1005.	Acute general peritonitis.	Case II.—Sudden onset with symptoms of peritonitis, nausea, vomiting, pains, tenderness, and elevation of pulse and temperature. Operation.	Recovery.
98. Stoner, A. P. (Jour. Amer. Med. Assoc., November 18, 1912, p. 1694).	Acute general peritonitis. Third day.	Case I.—Presented evidence of gonorrhea. General peritonitis of a moderate degree of virulence. Operation on third day. Diagnosis of general peritonitis confirmed, and gonococci recovered from the pus present in the peritoneal cavity. Right tube ruptured at distal extremity. Left tube normal. Right salpingectomy. Cause of rupture not reported. From the report it is difficult to determine if this case is an actual rupture or is a leakage through the distal end of the tube. Drainage.	Recovery.
99. Stoner, A. P.: <i>Ibid.</i>	Acute general peritonitis. Second day.	Case II.—Age twenty-three. Contracted gonorrhea six months previously and had suffered from symptoms of pelvic inflammatory disease. Spontaneous rupture, followed by symptoms of general peritonitis of a moderate degree of virulence. Operation on second day. General peritonitis was present, due to the rupture of a right tubo-ovarian abscess. Left adnexa diseased. Bilateral salpingo-oophorectomy. Pus from peritoneal cavity contained gonococci. Drainage.	Recovery.

## TORSION OF INFLAMED UTERINE ADNEXA

This is a rare condition, and a search through the literature shows comparatively few recorded cases, when the frequency of inflammatory lesions of the adnexa is borne in mind. The reason for this can easily be understood when the anatomy of the tube and ovary is considered. The two requisites for torsion of these structures are freedom or laxity of adhesions of the tube or ovary, and a sufficiently long-drawn-out condition of the attachment of the organs so as to form a pedicle. Until the last few years torsion of the inflamed Fallopian tube has attracted but little attention in this country, although quite a few cases have been reported on the Continent, especially in France, where Hartmann and Reymond,<sup>1</sup> Maillard,<sup>2</sup> Cathelin,<sup>3</sup> and Simount<sup>4</sup> have published monographs on this subject. In 1899 Praeger<sup>5</sup> reported two cases, and was able to collect 20 others from the literature. Three years later Cathelin's<sup>6</sup> work appeared, in which he reviewed the histories of 41 cases. The lines are not, however, sufficiently tightly drawn by Cathelin,<sup>7</sup> who, for example, admits a case of parovarian cyst to his list. Hartmann and Reymond<sup>8</sup> show the same laxity, as in their category they include a case of torsion of a normal Fallopian tube, and another in which an ovarian neoplasm was present. As torsion of ovarian and other new-growths of the adnexa is by no means unusual, these specimens should not be included under the heading of twists of inflamed uterine adnexa. Praeger<sup>9</sup> and Bell<sup>10</sup> very properly exclude all such cases from their reports. Bell,<sup>11</sup> in 1904, adds to Cathelin's<sup>12</sup> list 13 new cases, including one of his own. It has been found impossible, owing to the paucity of many of the reports, to analyze these cases from the bacteriologic standpoint. In the Laboratory of Gynecologic Pathology at the University of Pennsylvania one case of torsion occurred among 925 inflammatory tubal lesions, 147 of which were either hydrosalpinx or hematosalpinx. The history of this

<sup>1</sup> Hartmann, H., and Reymond, É.: *Annales de Gyn.*, 1898, vol. 4, p. 161.

<sup>2</sup> Maillard: "De la torsion des salpingitis," Thèse de Paris, 1897-98.

<sup>3</sup> Cathelin, F.: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.

<sup>4</sup> Simount, G. J. P.: "De la torsion du Pedicule dans les Salpingitis," Bordeaux, 1908, p. 56.

<sup>5</sup> Praeger: *Arch. f. Gyn.*, 1899, vol. lviii, p. 583.

<sup>6</sup> Cathelin: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.

<sup>7</sup> Cathelin: *Loc. cit.*

<sup>8</sup> Hartmann and Reymond: *Loc. cit.*

<sup>9</sup> Praeger: *Arch. f. Gyn.*, 1899, vol. lviii, p. 583.

<sup>10</sup> Bell, R. H.: *Jour. Obst. and Gyn. of Brit. Emp.*, 1904, No. 5, p. 511.

<sup>11</sup> Bell, R. H.: *Ibid.*

<sup>12</sup> Cathelin: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.



case has been fully recorded by Anspach,<sup>1</sup> together with a synopsis of 87 other cases collected from the literature.

The exact etiology of torsion of inflamed uterine adnexa is difficult to determine, but is probably largely influenced by the same factors that are known so frequently to produce similar conditions in cases of ovarian neoplasms. Among the causative agents, therefore, are length of the pedicle, irregularity in the shape of the tumor, flaccidity of the abdominal walls, alternate filling and emptying of the bladder and rectum, peristaltic movements of the intestines, and rapid alterations in intra-abdominal pressure, such as are produced by pregnancy, labor, paracentesis abdominalis, alternate distention and evacuation of the intestines, sudden, unusual, or constrained movements of the body as a whole, such as stooping, turning the body to get out of bed, vomiting, trauma, falls or jolts, administration of an enema, gynecologic examinations, pressure of the abdomen against a hard object, as a wash-tub, etc.

Bell<sup>2</sup> lays particular stress upon the action of the diaphragm in these cases. Payr<sup>3</sup> has directed attention to another and what he believes to be an important factor in the production of torsion. This author believes that venous stasis in the pedicle, especially of small, freely movable tumors, may cause them to twist. The veins in many such pedicles are extremely tortuous,—much more so than the arteries,—and as a result of intense congestion, impart a spiral motion to the tumor; as twists occur the stasis becomes increased and a sort of vicious circle is formed. Payr's article contains a number of illustrations. The ovarian veins are normally unusually tortuous, so that the foregoing theory is particularly applicable to torsion of inflammatory tumors of the adnexa. Naturally, on account of adhesions and the shortness of the pedicle, twists occurring in appendages the seat of inflammatory disease are of rare occurrence.

The ovary itself, owing to its situation and lack of pedicle, is rarely primarily subject to this condition, although not infrequently it participates more or less when the tube is twisted. Tubes the seat of pus collections seldom undergo torsion. A pyosalpinx is, as a rule, densely adherent throughout its entirety to the adjacent structures, and, owing to its generally smaller size compared to a hydrosalpinx, is much less likely to undergo twists than is a tube affected with the latter condition. In Anspach's<sup>4</sup> series of 88 cases of tubal torsion

<sup>1</sup> Anspach, B. M.: *Amer. Jour. Obst.*, October, 1912, p. 553.

<sup>2</sup> Bell, R. H.: *Jour. Obst. and Gyn. of Brit. Emp.*, 1904, No. 5, p. 514.

<sup>3</sup> Payr: *Arch. f. klin. Chir.*, 1902, vol. lxxviii, p. 501; also *Deut. Zeitschr. f. Chirurg.*, 1906, vol. lxxxv, p. 392.

<sup>4</sup> Anspach: *Trans. Amer. Gyn. Soc.*, 1912.



FIG. 35.—ACUTE PURULENT SALPINGITIS.

The tube is pipe shaped, and more closely resembles a serous than a purulent accumulation. The inner half of the tube is but little enlarged, and the mesosalpinx is thin. The ampulla is dilated. The walls are thin, and the surface shows only a few slight adhesions. The abdominal ostium is contracted, and the fimbriae are still to be seen. On section, the lumen was found to be necrotic and filled with pus. This is the type of purulent tubal accumulation in which torsion may occur.



there were 12 pyosalpinges, not all of which were, however, primarily pus-tubes; of these, 3 were known to be tubercular and 3 more were possibly the result of this type of infection. This is only what would be expected, as tuberculosis tends to produce a retort-shaped tubal enlargement more often than does the gonococcus or the other pyogenic microorganisms. Also in tuberculosis the adhesions are often less marked than in the other forms of infection.

In Cathelin's<sup>1</sup> list of 41 observations there were only 6 pyosalpinges, and he gives reasons for thinking that even these were not primarily cases of purulent salpingitis, but were, rather, originally hydrosalpinges with subsequent intratubal suppuration. A hydrosalpinx, on the other hand, because of the frequent retort-like shape the tube assumes, which tends to elongate the isthmus of the tube and the mesosalpinx, and thus forms a pedicle, is much more prone to develop this complication. The adhesions in hydrosalpinges are generally less numerous, and cases in which the ampulla of the tube is entirely free are not unusual. Without exception, all the recorded cases that are accompanied by a detailed description of the shape of the tube show that the chief enlargement is situated in the ampulla, and this is usually connected with the cornua of the uterus by a fairly long, gracile pedicle, consisting of the inner portion of the tube and the drawn-out and more or less thinned mesosalpinx. As previously pointed out, there can be no doubt that many of the cases reported as torsion of a pyosalpinx are in reality cases of hydrosalpinx in which pus or purulent material has formed as a result of the interference with the blood-supply caused by the twisting. The large proportion of cases of hydrohematosalpinges and hematosalpinges can also be accounted for in the same manner, just as hemorrhage occurs in an ovarian cyst when its pedicle is twisted.

**Direction of Rotation.**—The methods of describing this condition are, as a rule, confusing. The best plan is that adopted by the French writers, who state that the rotation is in the direction in which the hands of a watch travel, or is in the opposite direction. It is understood that the back of the watch is supposed to be toward the uterus and the face directed outward toward the tumor or the crest of the ilium. Cathelin<sup>2</sup> gives the analysis of 12 cases in which it was possible accurately to determine the direction of the torsion.

<sup>1</sup> Cathelin: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.

<sup>2</sup> Cathelin: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.

## RIGHT SIDE:

In the direction of the hands of a watch.....	2 cases
In the reverse direction of the hands of a watch.....	5 "

## LEFT SIDE:

In the direction of the hands of a watch.....	2 cases
In the reverse direction of the hands of a watch.....	3 "

It can thus be seen that there appears to be no rule in this respect.

The following table shows the ages at which torsion occurred in the 46 cases in which it was possible to determine this point:

1 case was under twenty years of age.
16 cases were between twenty and thirty years of age.
20 " " " thirty and forty years of age.
8 " " " forty and fifty years of age.
1 case was between fifty and sixty years of age.

Pregnancy does not seem to be a predisposing factor of much moment so far as torsion is concerned. Bell<sup>1</sup> states that of 38 cases, 10 were nulliparous, and 15 had only had one labor; while in Anspach's<sup>2</sup> series 38 out of 65 cases in which the condition was noted had one or more children, a not unusual proportion.

At the same time, several cases have been directly associated with pregnancy or the puerperium. Numerous pregnancies would naturally weaken the abdominal walls and thus favor torsion. On the other hand, inflammatory disease of the adnexa usually produces sterility, and unless the infection occurred as a result of childbirth, hydrosalpinx and other inflammatory tumors are generally absent during the puerperium.

Torsion of the inflamed appendages, like a similar condition occurring in the pedicle of ovarian neoplasms, may be either of sudden onset, the twist interfering with the blood-supply of the tumor to such an extent that gangrene or other severe circulatory disturbances are produced, or the rotation may be slow and perhaps repeated a number of times, producing a more chronic lesion. No sharp line can be drawn between these two varieties, as various intervening degrees of torsion may be encountered. The acute type is the variety that has been most frequently recorded.

In the cases recorded by Ries,<sup>3</sup> Rouffart,<sup>4</sup> Guicciardi,<sup>5</sup> Kauffmann,<sup>6</sup> and Kadigrobow,<sup>7</sup> the torsion had been so complete as to produce an

<sup>1</sup> Bell, R. H.: Jour. Obst. and Gyn. of Brit. Emp., 1904, No. 5, p. 514.

<sup>2</sup> Anspach: Trans. Amer. Gyn. Soc., 1912.

<sup>3</sup> Ries: Amer. Gyn. and Obst. Jour., April, 1900, p. 325.

<sup>4</sup> Rouffart: Jour. Med. de Bruxelles, 1900, No. 12, ref. Zent. f. Gyn., 1900, vol. xxxvii, p. 975.

<sup>5</sup> Guicciardi, G.: Ginecologia, 1905, vol. ii, p. 110, 1 pl.

<sup>6</sup> Kauffmann: Zent. f. Gyn., 1903, vol. xlix, p. 139.

<sup>7</sup> Kadigrobow, B. A.: Abst. Zent. f. Gyn., 1907, No. 32, p. 991.

amputation of the tube, and in Waldo's<sup>1</sup> case the tube was almost twisted off. Tubes the seat of the torsion usually present a dark reddish or blackish appearance, and show the same circulatory changes that are observed in ovarian neoplasms under similar circumstances. As before mentioned, the tubes that are the seat of torsion are usually of the retort-shaped variety, the outer end being enlarged, in the inner portion forming the more or less slender pedicle. As a result, the twists are almost always formed in the proximal half of the tube.

**Symptoms.**—These naturally depend upon the acuteness of the condition. A history pointing toward a previously existing pelvic inflammatory lesion can usually be elicited, whereas not infrequently prior attacks of torsion of a mild degree will have been present. In some cases the acute attack seems to have been produced by a sudden strain, as in Ross's<sup>2</sup> case, in which the twist was probably caused by the patient cranking a motor car. In other cases a fall, violent exertion, or straining at stool seems to have been the causative factor, while in still other instances the condition has occurred without assignable cause.

In some cases the torsion is gradual and the onset of symptoms only moderately acute, while in others the torsion seems almost completely to shut off the blood-supply, and as a result the symptoms are severe. In some cases it seems likely that a number of attacks caused by a gradual torsion have occurred. In 63 per cent. of the recorded cases the patients have been kept under observation for a time before operation, showing that in a definite proportion the symptoms at the onset were not very alarming. Many of these cases were at first mistaken for an ordinary acute exacerbation of a pelvic inflammatory disease. In 17 of Cathelin's<sup>3</sup> cases in which menstruation is mentioned, in only 4 was there any irregularity. The seizure is almost invariably ushered in by an attack of severe, sharp pain in the lower abdomen, over the seat of the lesion. This is accompanied by more or less marked symptoms of shock and collapse, which are followed shortly by the evidence of acute pelveoperitonitis, which not infrequently becomes general. Nausea, vomiting, hyperpyrexia, and elevation of the pulse-rate are prominent symptoms. The abdomen becomes distended and tender, the recti muscles rigid, and constipation is the rule, and in some cases is absolute. Retention of urine or irritability of the bladder and frequency of micturition are often observed. Examination reveals the presence of a more or less fluctuating tumor, which seldom rises

<sup>1</sup> Waldo: *Amer. Jour. Obst.*, August, 1901, p. 179.

<sup>2</sup> Ross: *Amer. Jour. Obst.*, 1906, vol. liv, p. 633; also *Trans. Amer. Assoc. Obst. and Gyn.*, 1906, New York, 1907.

<sup>3</sup> Cathelin: "De la torsion des hydrosalpinx," *Rev. de Chir.*, Paris, 1901, vol. xxiii, p. 253.

above the umbilicus and is of pelvic origin. This may be situated either in the pelvis or in the abdomen, but is usually low down. In cases in which a pelvic examination has been made prior to the attack, the change in the shape and consistence of the tumor will be a great aid in clearing up the diagnosis. Subsequent to the torsion the tube will be found to be somewhat enlarged, extremely tender, and often firmer than formerly, and to possess a rather more circumscribed range of mobility. The enlargement is sometimes very marked. Bimanual examination may show that the position of the uterus is altered. The presence of inflammatory disease of the opposite side is suggestive, as more than one-half of the recorded cases show this to be present. It may also be possible to demonstrate the pedicle of the tumor and its association with the uterus. These patients usually display such tenderness on examination, and the abdomen is often so markedly distended, that a general anesthetic is necessary before a satisfactory examination can be made.

**Diagnosis.**—Bell<sup>1</sup> and Anspach<sup>2</sup> state that an absolutely correct diagnosis of this condition has never been made. Torsion is somewhat more frequent on the right than on the left side. In the 88 cases analyzed by Anspach,<sup>3</sup> 44 occurred on the right, 33 on the left, side, 7 were bilateral, and the location of the remainder was not stated. The less space on the left side of the pelvis, owing to the presence of the sigmoid flexure, the more active peristalsis of the small intestines, and the cecum on the right, and perhaps the greater frequency of infection of the right tube, owing to the close anatomic relationship to the vermiform appendix, may perhaps account for this fact. As a result of torsion, rupture may occur, as in the cases of Lejars<sup>4</sup> and Caput.<sup>5</sup>

The symptoms and the abdominal and pelvic examination so closely simulate torsion of the pedicle of an ovarian tumor, and the latter condition is relatively so frequent, that torsion of inflamed appendages is usually mistaken for an ovarian neoplasm. Ovarian tumors are often round, and this point should be considered, as well as the fact that the latter are not, as a rule, associated with the other symptoms of pelvic inflammatory disease. Small ovarian tumors are the most difficult to differentiate. Torsion may also be mistaken for appendicitis and intestinal, renal, or ureteral colic. These conditions should, however, readily be excluded if a careful study of the case and a thorough pelvic examination are made. Certain cases of ruptured

<sup>1</sup> Bell, R. H.: Jour. Obst. and Gyn. of Brit. Emp., 1904, No. 5, p. 514.

<sup>2</sup> Anspach: Trans. Amer. Gyn. Soc., 1912.    <sup>3</sup> Anspach: Trans. Amer. Gyn. Soc., 1912.

<sup>4</sup> Lejars, F.: Compt. rend. Soc. d'obstet., de gynec. et de pædiat. de Paris, 1909, vol. xi, p. 342; also *Semaine méd.*, Paris, 1910, vol. xxx, p. 325.

<sup>5</sup> Caput: Rev. de Gyn., 1906, vol. x, p. 963.



ectopic pregnancy may also closely simulate torsion, but the history, the absence of other evidences of inflammatory disease, and the fact that in the latter the symptoms of hemorrhage are absent, should aid the operator in making his diagnosis. Torsion of gravid tubes has been recorded. Fortunately, the correct diagnosis is, as a rule, of no great practical importance, as operative intervention is required in all the conditions for which torsion is likely to be mistaken.

In the 87 cases summarized by Anspach,<sup>1</sup> 25 were diagnosed as ovarian cysts with twisted pedicle, in 20 as pelvic inflammatory disease, in 2 as gynatresia with distention, in 1 as acute strangulation of the intestine, and in 30 no clinical diagnosis was made. One remarkable case presented no subjective symptoms whatever, the tumor being discovered accidentally.

**Treatment.**—Briefly summarized, it may be stated that immediate operation is required in all cases of torsion, and the earlier it is performed, the more favorable will be the prognosis. The type of operation selected will naturally vary according to the nature and extent of the pathologic condition encountered. If the lesion is confined to one side, the opposite appendages being normal, a simple salpingo-oöphorectomy, with excision of the intramural portion of the tube and retention of the uterus in a good position, will usually be all that is necessary. On the other hand, if the lesions are extensive, a more radical operation will be required.

The following is a summary of recorded cases, many of which have been taken from Anspach's<sup>2</sup> excellent paper on this subject. As has previously been mentioned, the etiology of many of these cases is in doubt. None, however, is included which is known to be caused by microorganisms other than the gonococcus.

*Albertin* (Lyon Méd., 1911, vol. cxvii, p. 29).—Hydrosalpinx, twisted on uterine pedicle, ecchymotic in color and indicative of necrosis.

*Albertin* (Lyon Méd., 1905, vol. cv, p. 1040).—*Case 1.*—Age, eighteen. Diagnosis before operation: Bilateral ovarian cyst. Diagnosis after operation: Bilateral hydrosalpinx. Right, twisted. Opposite side, hydrosalpinx and ovarian cyst. Repeated attacks of ovarian pain.

*Case 2.*—Age, sixteen. Hydrosalpinx. Twisted three times, with repeated attacks and abdominal pain becoming progressively worse. Diagnosis before operation: Ovarian cyst with twisted pedicle.

*Amann* (Monat. f. Geb. u. Gyn., vol. xv, No. 2).—Age, thirty-three. II-para. Sudden attacks of severe pain. Previous good health. Median abdominal tumor three inches below umbilicus. Operation ten days after attack. Diagnosis before operation: Ovarian cyst, torsion. Diagnosis at operation: Right hydrosalpinx, twisted 2½ times. Tube, 20 cm. long and 6 cm. in diameter. Number of adhesions to intestine and mesentery.

*Arthur* (Deut. Zeit. f. Chir., vol. xlviii, Nos. 2 and 3, p. 198).—Age, twenty-one. Diagnosis before operation: Appendicitis or right adnexal disease. Seven days before operation

<sup>1</sup> Anspach: *Loc. cit.*

<sup>2</sup> Anspach, B. M.: Amer. Jour. Obst., October, 1912, vol. lxvi, p. 553.

acute symptoms began. The tumor was present in the right iliac fossa, which was easily outlined. At operation hydrosalpinx was found in the right side, the size of an ostrich egg, the pedicle of which was twisted.

*Aulhorn* (Zent. f. Gynäk., 1910, No. 16, p. 538).—Age, nineteen. Three months pregnant. Pain for some weeks. Acute exacerbation two days before admission. Diagnosis before operation: Pregnancy and pyosalpinx. Diagnosis after operation: Right hematosalpinx, twisted 180 degrees; tumor 9 cm. long, dark-blue color; ovary involved; uterus gravid.

*Balburn* (Amer. Jour. Obst., 1906, vol. liv, p. 654).—Age, forty-three. No children; one miscarriage. In attempting to sit down, missed chair and fell heavily; three hours later, severe pain. Diagnosis before operation: Acute appendicitis. Emergency operation. Ovaries not disturbed and not affected. The tubes contained serum and blood. Diagnosis: Bilateral hydrosalpinx, right tube twisted and gangrenous.

*Baudron* (Compt. Rend. Soc. d'obst. de Gyn. et de Pæd., 1900, vol. ii, p. 90).—Age, thirty-two. One miscarriage at nineteen years. Diagnosis before operation: Tubal pregnancy (ruptured). Diagnosis after operation: Hydrosalpinx, twisted. Side, right. Size, orange. Location, tumor adherent to parietal peritoneum of pelvis. Form, irregular, nodular, ecchymotic. Pedicle, size of little finger. Torsion.

*Bell* (Jour. Obst. and Gyn. of Brit. Emp., 1904, No. 5, p. 514).—Age, forty-five. Married at nineteen; child in eighteen months; no other pregnancies. Family history tuberculous. Attack of severe pain in 1899, with faintness and vomiting; lasted two hours; no doctor. In 1901, another. Present attack sharpest. Abdominal tumor found. Diagnosis before operation: Ovarian cyst, twisted pedicle. Diagnosis: Hydrosalpinx, twisted  $1\frac{3}{4}$ , reversely to hands of watch. Twisted tube almost black in color. Left side also inflamed.

*Blund-Sutton* (Surg. Dis. of the Ovary and Fallopian Tubes, London, 1891).—Case of Dr. H. Morris. Symptoms not acute; ovary not involved. A hydrosalpinx was twisted  $3\frac{1}{2}$  times. Numerous dense adhesions and partial amputation and parasitic growth resulting from impairment of the normal blood-supply.

*Boursier* (Jour. de méd. de Bordeaux, 1901, No. 30, p. 512).—Age, thirty-four. Nullipara. Diagnosis before operation: Endometritis; adherent retroflexion; salpingo-oöphoritis (right). Diagnosis after operation: Right hydrosalpinx, twisted  $2\frac{1}{2}$  times. Opposite side, follicular cysts in ovary, congested tube. In 1899 severe pains right iliac fossa, especially if fatigued, increased at menstrual periods; gradually grew worse, coming on in attacks when fatigued. During month before admission (1901) pains suddenly increased in violence without apparent cause; went to bed; slight fever and painful micturition. Objective signs: Abdomen not distended. Behind and to the right of uterus a mass not very hard, difficult to outline; tender. Operation: Right salpingo-oöphorectomy. Result, cure.

*Brewis, N. T.* (Edinburgh Med. Jour., 1910, N. S. 4, vol. i, p. 448).—Showed an example of torsion of the tube before the Edinburgh Obstetrical Society. There was no description of any kind.

*Burrage* (Bost. Med. and Surg. Jour., 1906, vol. cliv, No. 11, p. 295).—Age, twenty-six. Married two years; nullipara. Treated for dysmenorrhea December, 1898. Dudley's operation. Pelvis negative, except prolapse of right ovary. Acute attack November, 1899. Diagnosis before operation: Pelvic abscess. Diagnosis after operation: Hydrosalpinx twisted. Right salpingectomy; resection of both ovaries. Left tube normal. Both ovaries riddled with cysts. Twisted right hydrosalpinx adherent to bladder and surrounding structures. Color, dark, reddish-brown. Contents, blood-clot, no villi.

*Cathelin* (Rev. de Chirurg., 1901, vol. xxiii, p. 253).—Age, twenty-six. One miscarriage of five months seven years previously. Diagnosis before operation: Massive salpingitis (left); slight adnexitis (right). Diagnosis after operation: Left hydrosalpinx, twisted  $2\frac{1}{2}$  times. Form, ovoid; color, blackish; contents, 200 grams blood; no clots; adhesions present. Ovary not twisted. Adnexa of opposite side normal. Objective signs: Tender mass in posterior culdesac (left). Subjective conditions: Very active pains in left lower abdomen three years before operation, without other symptoms; for three years uterine discomfort. Evening before operation, violent pains on rising from a chair. Operation: Unilateral salpingo-oöphorectomy. Result, cure.

*Cathelin* (Bull. et mém. de la Soc. de Anat. de Paris, 1900, 6 S., T. ii, vol. lxxv, p. 673).—Age, forty; 11-para. Sudden seizure; repetition in sixteen days; mobile tumor on right,

by pelvic examination. Left hydrosalpinx, twisted  $1\frac{1}{2}$  times, direction of hands of watch. Ovary not involved. Blackish tumor. Right hydrosalpinx adherent in Douglas' pouch.

*Clado* (Bull. et mém. de la Soc. de Anat. de Paris, 1900, 6 S., vol. ii, p. 41).—Age, thirty. Nullipara. Diagnosis before operation: Bilateral salpingitis. Acute exacerbation on right side. Objective signs: Abdomen distended on right side, rising nearly to umbilicus. On left side, tumor size of mandarin orange, fluctuant. At operation: Right hydrosalpinx, twisted 3 times and contained 300 grams dark, bloody fluid and a small hemorrhagic cyst of the ovary. Operation: Bilateral salpingo-oophorectomy. Result, cured.

*Delbet, P.* (Bull. et mém. de la Soc. de Anat. de Paris, 1892, p. 300).—Age, thirty-nine. Diagnosis before operation: Intestinal strangulation from bands of volvulus of sigmoid. Operation within thirty-six hours. Diagnosis after operation: Left hydrosalpinx, 3 twists. Right hydrosalpinx. Left ovary not twisted. Objective signs: Palpation very painful. Subjective conditions: Very sudden and severe pain; fainting. Patient fell while walking on street. Continued vomiting, not fecal. Pulse full, rapid; temperature, normal. Operation: Bilateral salpingo-oophorectomy. Result, cure.

*Delore and Alamartin* (Lyon Méd., 1909, No. 9, p. 416).—Age, thirty-eight. No general history. No signs of inflammation. Diagnosis: Bilateral hydrosalpinx, right twisted 2 or 3 times, containing one-half liter of fluid and shaped somewhat like a bagpipe. Operation: Right salpingectomy. Left salpingo-oophorectomy. Result of operation not stated.

*Fraenkel, L.* (Monats. f. Geb. u. Gyn., vol. xxxv, No. 4, p. 459).—Age, twenty. Nullipara. Appendectomy five years before present attack. Fourteen days prior to operation severe pain in lower abdomen and vomiting. Diagnosis before operation: Bilateral ovarian cyst, torsion. Operation revealed right pyosalpinx the size of a man's fist and a twisted pedicle. Tube measured 20 cm. Left side similar, but no torsion. Bacteriologic examination.

*Françis* (Société Anatomique, October 30; La Presse médicale, No. 89).—Cystic salpingitis with torsion of pedicle. Abundant hemorrhage in tubal wall; hemorrhagic fluid in cyst cavity. Other tube normal. [No other data given.]

*Fritsch, H.* (Die Krankheiten der Frau, Braunschweig, 1894, p. 469).—Simply declares that every hematosalpinx is not a tubal pregnancy and reports a very movable hematosalpinx with a twisted pedicle, but gives no details. Diagnosis: Hydrosalpinx, twisted, size of fist.

*Funke* (Hegar's Beiträge, 1904, vol. vii, No. 3, p. 450).—Age, twenty-eight. Typhoid fever at twenty. Abdominal tumor for one-half year, increasing in size. Diagnosis before operation: Inflamed tumor of left adnexa. Diagnosis after operation: Hydrosalpinx, twisted. Left side affected, well hidden by adhesions. Right also hydrosalpinx, not adherent, also twisted. Ovary, normal; left twisted  $1\frac{1}{2}$  times opposite to direction of the hands of a watch; right twisted  $\frac{1}{2}$  with watch; clear yellow fluid.

*Gosset and Raymond* (Ann. de Gyn., 1899, p. 21).—Age, thirty-one. III-para. Seat of tumor, left; size of fist. Pedicle twisted at 2 cm. from uterus. One twist in direction contrary to hands of watch. Contents, chocolate-colored fluid. No adhesions. Ovary twisted. Opposite adnexa healthy. Objective signs: Suprapubic mass rising to five fingers above pubis; slight lateral mobility; posterior culdesac filled by resistant mass corresponding with the suprapubic tumor. Pain since first pregnancy, especially at periods. After a long walk suddenly seized with severe pains in abdomen, most severe in left flank, radiating to lumbar region. Vomiting of food and bile. Operation. Result, cure.

*Goullioud* (Quoted by Cathelin: Rev. de Chirurg., 1901, Nos. 2 and 3, p. 263).—Age, thirty-seven. Nullipara. Diagnosis before operation: Pelvic myoma complicated by ovarian cyst. Diagnosis after operation: Fibroma uteri and hydrosalpinx, twisted. Seat of tubal tumor, right, size of child's head. Two twists. Contents fluid, hemorrhagic, not viscid. Ovary twisted. Opposite adnexa cystic. Objective signs: Abdomen distended; myoma reaching to umbilicus. In front of this hard tumor another, which is fluctuating, not reaching to symphysis. In right iliac fossa another smaller tumor, size of an egg, very hard and tender. For the eight days before admission to hospital acute pain with sudden enlargement of abdomen. Pain radiating to right leg. Operation: Bilateral salpingo-oophorectomy. Result, cure. Remarks: After operation, retrogression of fibroma and improvement in pulmonary and pleural tuberculous lesions. The pelvic infection may have been tubercular. Not stated.

*Guicciardi, G.* (Ginecologia, 1905, No. 4).—Age, forty-nine. Single. Left tube and ovary

- and right ovary adherent. Right sactosalpinx, enlargement confined to ampulla. A number of twists occurred in the isthmus of the tube, and finally the tube became twisted off, leaving a uterine stump 3 cm. in length. Guicciardi has seen 5 cases of tubal torsion in 1041 laparotomies, with 3 actual amputations of the enlarged tube.
- Harpöth* (Zent. f. Gyn., 1900, No. 52, p. 1399).—Age, twenty-six. No evidences of infection mentioned. Operation six weeks after acute attack. Diagnosis before operation: Ovarian cyst and torsion; general health good. Diagnosis after operation: Bilateral hydrosalpinx, left twisted  $2\frac{1}{2}$  times. Although not definitely stated, presumably no tubal, but a few omental, adhesions. No bacteria found on microscopic examination and no cultures.
- Hartman, H., and Reymond, E.* (Annal. de gyn., September, 1894, vol. xlii, p. 172).—Age, thirty. Subjective conditions: Pains in right side of abdomen. For last three years patient noticed tumor. Occasional severe attacks accompanied by vomiting. Right hydrosalpinx and cystic ovary. Adhesions to surrounding organs. Contents,  $1\frac{1}{2}$  liters sanguinolent fluid. Diagnosis: Right hydrosalpinx, 2 twists in direction of hands of watch.
- Hartman, H., and Reymond, E.* (Annal. de gyn., 1898, vol. i, p. 161).—Nullipara. Diagnosis before operation: Bilateral salpingitis. Diagnosis after operation: Bilateral hydrosalpinx, left tube being twisted in direction opposite to hands of watch several times. This tumor is dark red, lobulated, and possesses a pedicle the size of a finger. It contained 400 grams bloody fluid. A number of adhesions were present on the right side. The uterus itself was twisted  $\frac{1}{2}$ . Objective signs: Increase in size of tumor, tenderness, dulness, and symptoms of peritonitis, with violent pains in right side radiating down thigh. Operation: Salpingo-oöphorectomy. Cured.
- Hartman* (Ann. de gynéc. et d'obst., Paris, 1900, vol. liii, p. 119).—*Case 1.*—Age, forty-four. Pains in right side of abdomen, coming on in attacks for two years. Examination: Subumbilical tumor; fluctuating. Right side. Pedicle size of umbilical cord. Twisted twice. Color, brown. Contents, 500 grams blood. No mention of just what composed tumor—tube (?), ovary (?), both (?). No mention of opposite adnexa. Result, cure.
- Case 2.*—Age, twenty. When five to six months pregnant, suddenly seized with pain in right iliac region; vomiting; distention; fever. Operation next day. Right adnexa enlarged, adherent, hemorrhagic. Pedicle twisted once. Removal. Cure. Normal delivery at term.
- Case 3.*—Age, thirty-three. Curetage several times for metrorrhagia. December 7, 1899, sudden violent abdominal pains; in following days signs of pelvic peritonitis gradually subsiding. Tenderness remained. Large mass in abdomen, reaching to umbilicus. Operation January 3, 1900. Large blackish tumor formed by right hydrosalpinx, with pedicle twisted directly. Ovary not involved. Uterus twisted  $\frac{1}{2}$ . Contents: Sterile fluid.
- Hartman, C. R.* (Compt. rend. de la soc. d'obst. de gyn. pæd., Paris, 1900, vol. p. ii, 254).—Age, twenty-five. 1-para (eight months previous). Diagnosis before operation: Appendicitis or tubal disorder. Diagnosis after operation: Hydrosalpinx, twisted (right)  $\frac{1}{2}$ . Numerous adhesions. Ovary twisted. Opposite adnexa: Adhesions. Objective signs: Abdomen flaccid; tumor in hypogastrium, reaching to right iliac fossa; irregular; painful. Per vaginam, mass posterior to uterus, continuous with abdominal tumor. Six weeks previous to operation sudden abdominal pain without vomiting; fever. Operation: Unilateral salpingo-oöphorectomy. Result, cure. Remarks: Appendix adherent; removed.
- Hedley, J. P.* (Proc. Roy. Soc. Med., London, 1907-08, vol. i, p. 95).—Age, twenty-three. Single. Acute symptoms came on in a tram-car. Operation after seventeen days of acute pain in lower abdomen. Removal of affected tube. Diagnosis: Left hydrosalpinx twisted twice in direction of hands of watch; size of small orange. Contents: Sterile, thin, blood-streaked fluid. Ovary and appendix normal. No adhesions mentioned. Recovery.
- Herff, v.* (Verhandl. d. Gesell. f. Gyn., Kong., 1895, p. 695).—Exhibited a specimen of torsion of a hydrohematosalpinx. [No details.]
- Hirst* (Amer. Jonr. Obst., vol. xxxiii, p. 263).—Left side affected. Other pelvic organs normal. No other details. Diagnosis: Hydrosalpinx twisted 3 times, in association with myoma of uterus.
- Jacobs* (Zent. f. Gyn., 1896, No. 50, p. 1283).—Ill-defined pain through lower abdomen, chiefly on the right side. At operation a myoma of the uterus was found and removed by vaginal morcellment. Right pyosalpinx and right ovarian abscess. Tube was twisted 3 cm. from the uterus. No gangrene was present. The tubal walls were thin.

- Kadigrow, B. A.* (Abst. Zent. f. Gyn., 1907, No. 32, p. 991).—Age, twenty-six. Nullipara. Right hydrosalpinx; slow twisting; almost complete amputation of tube. String-like connection, 1 cm. long. Contents of tube: bloody fluid. Tumor oblong, disseminated red spots.
- Kauffmann* (Zent. f. Gynäk., 1903, vol. xlix, p. 139).—Age (?). III-para; one miscarriage. Diagnosis before operation: Retroflexion with adhesion. Much pain; unable to work. Diffuse adhesions of both adnexa. Right side affected; consisted of two parts, a short uterine stump and an outer portion, 3 cm. long, with fimbriated extremity closed. Diagnosis after operation: Right hydrosalpinx detached by torsion.
- Klein* (Monats. f. Geb. u. Gyn., 1912, p. 655).—Age, thirty-five. II-para. Diagnosis before operation: Ovarian cyst; twisted pedicle. Three attacks of pelvic peritonitis previously. Diagnosis after operation: Hydrosalpinx, twisted 360 degrees; ovary adherent; bluish-black tumor.
- Legueu and Chabry* (Rev. de Gyn. et de Chir. abdom., 1897, No. 1, p. 11).—This case appears to be the same as Case 1 in *Presse médicale*, 1900, p. 137. Multipara. Symptoms of pelvic inflammatory disease for some time prior to attack. Sudden onset of pain in ovarian region. Diagnosis before operation: Ovarian cyst with a twisted pedicle. Operation showed a large hydrosalpinx twisted. Opposite adnexa normal. Recovery.
- Legueu* (*Presse médicale*, 1900, p. 37).—*Case 1.*—Age, thirty-three. III-para. Diagnosis before operation: Ovarian cyst with a pyosalpinx. Diagnosis after operation: Hydrosalpinx, twisted. Contents, 400 grams blood; ovary not twisted. Opposite adnexa healthy. Objective signs: Above and to right umbilical tumor with rounded upper margin, whose lower end reaches into small pelvis. On palpation, resistant, tender; hardly to be felt per vaginam. Subjective conditions: Sudden pains at menstrual period, especially in the right side; vomiting of food and bile. Operation: Unilateral salpingo-oophorectomy. Result, cure.
- Case 2.*—Age, twenty-six. Diagnosis after operation: Right hydrosalpinx, size of hen's egg. Form smooth, regular. Twists,  $1\frac{1}{2}$  times. No adhesions. Ovary not twisted. Objective signs: Mobile tumor, slightly tender, in posterior culdesac, independent of uterus. Subjective conditions: acute pains in abdomen at menstrual periods for past two years, especially right. Leukorrhea only during intervals. Operation: Unilateral salpingo-oophorectomy. Result, cure.
- Lejars* (*La Gyn.*, January, 1910, p. 70; and *Compt. rend. de la soc. d'obst., gyn., pæd.*, Paris, 1909, vol. xi, p. 342).—*Case 1.*—Age, thirty-two. Diagnosis before operation: Fibroma (retroperitoneal). Subjective conditions: Three years previous, suddenly taken with pains in abdomen which lasted several days. Reappeared at menstrual periods and when fatigued. Three months before operation severe attack; bed for ten days. Objective findings: Mass size of fist anterior and to left of uterus. At operation: Large, blackish tumor anterior and left of uterus, everywhere adherent and corresponding to left adnexa, attached to left cornua by pedicle twisted twice, undergoing ulceration. [No microscopic examination.]
- Case 2.*—Age, thirty-one. III-para. No pain until two weeks before operation; sudden onset. Objective findings: Cervix large, hard; in right culdesac mass size of two fists, hard, fixed. Operation: Mass consists of large tube twisted; loop of intestine adherent. Contents, pus.
- Case 3.*—Age, thirty-eight. Nullipara; no miscarriages. Severe pains; sudden onset six weeks before admission. Examination: Nodular, hard tumor, fixed, reaching to three fingers below umbilicus, filling left iliac fossa. Operation: Myoma with many intestinal adhesions; left tube large, blackish, external half twisted, the torsion being maintained by fine, recent adhesions. Opposite adnexa normal. Operation: Hysterectomy and bilateral salpingo-oophorectomy. Cure.
- Case 4.*—Age, fifty. III-para. One miscarriage. For two months profuse metrorrhagia; leukorrhea. No severe pains; general feeling of weight in abdomen. Examination: Large adherent mass in pouch of Douglas, which appeared to be in large part constituted by retroflexed uterus. Operation: Uterus retroverted; on left, a prolapsed, blackish tube filled with hemorrhagic fluid, twisted several times on its pedicle. Cure.
- Case 5.*—Age, forty-three. Operated upon for uterine myoma. Bilateral hydrosalpinx size of lemons, each tube twisted on its pedicle.
- Case 6.*—Age, forty. History and symptoms of chronic salpingo-oöphoritis. Operation: Right ovary healthy; "the tube in its inner three-quarters, healthy; the ampulla was transformed into a little blackish pouch, attached to a twisted pedicle, and in part detached." Contents of the little pouch black, hemorrhagic liquid, mixed with a little pus. Diagnosis: Salpingitis, torsion, necrosis. The torsion and rupture had been eccentric and had involved only the ampulla. Opposite adnexa: Cystic ovary, tube large, closed.



*Case 7.*—Age, twenty. Pains in right abdomen came on one month before operation. Painful micturition. Examination: Round tumor in suprapubic region (right), size of an orange; consistence of dermoid, which was the clinical diagnosis. Operation: Large hydrosalpinx of left side, transposed to right, twisted 3 times on itself; torsion maintained by adhesions. Ovary healthy. Opposite adnexa normal; uterus, small. Result, cure.

*Lewers* (Trans. London Obst. Soc., vol. xlv, p. 362).—Age, thirty-seven. Single. First attack of pain and vomiting December, 1901; second, May, 1902; third, September, 1902. Diagnosis before operation: Bilateral ovarian tumor with twist of pedicle. Diagnosis after operation: Bilateral pyosalpinx, torsion on right side and adhesions to small intestine and bladder. Operation: October, 1902, bilateral salpingectomy. Diagnosis: Pyosalpinx twisted several times. Right ovary not involved.

*Maillard* (Thèse de Paris, 1893 and 1897, quoted by Leguen, Presse méd., 1900, p. 37—second case).—Age, forty-nine. III—para; last, seventeen years previous. Diagnosis before operation: Pyosalpinx, right, with less severe adnexal disease, left. Diagnosis after operation: Right hematosalpinx; twisted pedicle  $1\frac{1}{2}$  times in direction of hands of watch. Form, globular. Ovary normal. Contents, coagulated blood. Opposite adnexa: Ovary cystic. Objective signs: Uterus three fingers above symphysis. Tumor felt high in right culdesac, size of egg, resistant. Attached to uterus on one side, to pelvic wall on other. In left culdesac a smaller, long tumor, attached to uterus, slightly tender. Subjective symptoms: Menstruated at age of thirteen. Four years before operation leukorrhea, pain on urination, tenesmus; diagnosis of gonorrhea. Shortly afterward began to have abdominal pains, which for last year have considerably increased. These came on in attacks, always beginning on right side, radiating to lumbar region, and down thigh to knee; vomiting; distention of abdomen; attacks lasted three days, gradually passing into period of calm, generally lasting about one and one-half months. In year preceding operation had had 7 attacks. Result, cure. Operation: Supravaginal hysterectomy, bilateral salpingo-oophorectomy. Remarks: Myoma of uterus present.

*Martin* (Compt. rend. de la soc. d'obst., gyn., pæd., Paris, 1906, vol. viii, p. 147).—Age, thirty-four. Nullipara. Thought herself four months pregnant and threatened with miscarriage. Past four or five months distention of abdomen, accompanied with diminution in menstrual flow. Nausea and vomiting in morning. Just before admission suddenly seized with violent abdominal pains; vomiting. Examination: Uterus normal in size. In right culdesac a rounded, fluctuating tumor, tender, distinct from uterus. Diagnosis before operation: Torsion of pedicle of small ovarian cyst, or probably a right salpingitis. Operation: Smooth, fluctuating tumor in pouch of Douglas with no adhesions, which proved to be a right hydrosalpinx; ovary not involved. Opposite adnexa normal. Tube measures 11 x 9 cm.

*McIlroy* (Scottish Med. and Surg. Jour., August, 1904, p. 150).—Age, forty-three. Married. V—para. Last labor eleven months ago. Attack of pain during last pregnancy, and felt as if there was some obstruction to last delivery. Thereafter, pressure symptoms. Left side affected. Diagnosis after operation: Hydrosalpinx; outer third of tube enormously distended; 3 twists of tube at different parts in direction of hands of watch; outer third necrotic. This, McIlroy believed, was a parovarian cyst, but on studying the case more carefully believes it tubal. Complete torsion of tube at three distinct points; necrosis of outer cystic part, containing chocolate-colored fluid and flakes of fibrin. Parovarium distinct. Drawing resembles a parovarian cyst, but author regards it as a hydrosalpinx.

*McIlroy, A. C.* (Jour. Obst. and Gyn. Brit. Emp., 1910, vol. xviii, p. 368; also Proc. Roy. Med. Soc. London, 1910-11, Obst. and Gyn. Sec., p. 1121).—Age, forty-six. IV—para; last, twenty years ago. Severe pain in left iliac region, which came on suddenly five days ago. Chills and some symptoms of collapse. Menstruation irregular. Examination: Mass as large as orange. Diagnosis: Myoma of uterus or tubo-ovarian tumor. Operation: Uterus enlarged and mass size of orange adherent to posterior uterine wall, which proved to be a left hematosalpinx. Two twists in uterine end. Ovary not involved. Recovery.

*Michel* (Ann. de Gyn. et d'obst., 1907; ref. Zent. f. Gyn., 1909, vol. xxiv, p. 863).—Age, thirty-five. Married. II—para. Operation: Four weeks after first attack. Both sides affected. No pus in tubes, although had fever. Diagnosis: Hydrosalpinx, right; twisted 4 times. Hematosalpinx, left; twisted 3 times.

*Montgomery, E. E.* (Amer. Jour. Obst., 1912, vol. lxvi, p. 272).—Age, twenty-two. Presented symptoms suggestive of ectopic pregnancy. Operation showed a left pyosalpinx, probably gonorrheal in origin, with torsion.

- Morel* (Bull. et mém. de la soc. anat. de Paris, December, 1903, p. 863).—Age, thirty-two. IV-para. Diagnosis before operation: Ectopic pregnancy. Subjective conditions: Had missed no period. Severe pain on left side, spreading to entire abdomen. Vomiting bile. Examination of abdomen: Rigid, tender. Mobile, tender tumor in posterior culdesac. Operation (next day): Uterus large, appears gravid. Right adnexa normal. Posterior culdesac occupied by a mobile, violet-colored tumor, developed from left adnexa, size of turkey-egg. Pedicle twisted 5 or 6 times. Wall of tubal sac delicate, and the hemorrhagic contents can be seen through it. [No anatomic diagnosis; ectopic (?); hematosalpinx?]
- Nanu* (Bull. et mém. de la soc. de chir. de Bucarest, 1900, p. 160).—Trans.: "M. Nanu presented a specimen, obtained by abdominal hysterectomy, of a uterine myoma with both tubes. One of these, a right hematosalpinx, has the pedicle twisted about its axis; it occupied the position of the cecum, which it resembles in form. It has also adhesions to the omentum."
- Orthur* (Zent. f. Gyn., 1909, vol. xxix, p. 1025).—Age, thirty. Symptoms acute, followed straining at stool. Chills, vomiting, and pain. Operation after six days. Mass palpated a month before. Left tube thick as ball of thumb, swollen, and dark blue; mucosa necrotic. Tube twisted about 2 cm. from uterus, 1 $\frac{1}{4}$  times in direction of watch. Right tube, abdominal ostium closed and contained pus. Omentum adherent to fundus. Left ovary normal. Hemorrhagic infarcts in tube wall; tube seat of torsion, and contained pus and blood.
- Pierson* (Reported by Storer, Boston Med. and Surg. Jour., 1896, vol. cxxxv, No. 19, p. 461).—Diagnosis: Acute appendicitis. Right side affected. Pyosalpinx, which lay above pelvic brim, with fimbriated extremity looking toward the loin. Diagnosis: Pyosalpinx twisted 1 $\frac{1}{2}$  times, close to uterine end.
- Pinard and Paquy* (Compt. rend. de la soc. d'obst., gyn., pæd., Paris, October, 1901; *ibid.*, 1902).—The age in one reference is thirty-six and in the other twenty-six, but all other details are the same. I-para. Numerous severe attacks of pain during the second pregnancy and for past five years; vomiting in last attack; pain, nausea, frequent micturition, vomiting, diarrhea, meteorism, and icterus. Operation after induction of labor and emptying of uterus because symptoms continued, especially fever. Right side affected. Right salpingo-oophorectomy. Pregnant uterus. Diagnosis: Hydro-salpinx twisted twice, reversely to hands of watch; size of orange. Ovary normal.
- Poirier et Cathelin* (Bull. Soc. Anat. de Paris, 1900, p. 209).—Age, forty-two. III-para; last, twelve years previous. Diagnosis before operation: Retroflexed uterus or probably adnexal disease. Diagnosis after operation: Left, pear-shaped, nodular hydro-salpinx, size of orange. Twisted 3 $\frac{1}{2}$  times. Ovary also twisted. Objective signs: Resistant abdominopelvic tumor. Subjective conditions: Menstruated at twelve; irregular; active pains; metrorrhagia. Operation: Bilateral salpingo-oophorectomy. Result: Death next day. Remarks: Autopsy did not reveal cause of death.
- Polak, J. O.* (Amer. Jour. Obst., 1912, vol. lxvi, p. 272).—Age, nineteen. Acute onset of symptoms. Operation three days later. The tube had been converted into a hematosalpinx and measured 10 x 8 cm. Torsion. The ovary was not involved.
- Pozzi* (Compt. rend. de la soc. d'obst., gyn., pæd., Paris, 1900, p. 201).—Age, thirty-seven. III-para. In 1891 metritis following chilling during menstrual period. Extra-peritoneal evacuation of pus from left iliac region. Regained health. December, 1899, fever, vomiting, pain midway between umbilicus and anterior superior spine. Tumor size of mandarin at McBurney's point. Diagnosis before operation: Appendicitis. First operation, January 1, 1900: Right pyohematosalpinx size of orange, twisted once. Opposite adnexa not examined (right ovary also twisted). Convalescence normal until January 11th. Pain left iliac region, beneath scar of operation in 1894, fever. Second operation January 14, 1900. Left iliac incision. Pus cavity adherent to scar. Pyosalpinx blackish in color, twisted once. Ovary carried down and forward; tube up and backward. Resembles adnexa of opposite side. Salpingo-oophorectomy. Result, cure.
- Pozzi* (Compt. rend. de la soc. d'obst., gyn., pæd., Paris, 1900, vol. ii, p. 95).—This is same as case in Rev. de gyn. et chir. abd., April 10, 1900, p. 160. Age, thirty-three. I-para (forceps). Subjective conditions: Metritis at age of twenty-eight, from time to time thereafter attacks of pain lasting two weeks at a time, not at menstrual periods. January, 1900, very severe pains in lower abdomen. From then on several attacks of abdominal pain and constant bleeding until operation. Objective findings: Cervix large, soft, patulous. Uterus large; to left and in front of uterus a cyst size of fetal head; on right, slight induration. Diagnosis before operation: Ovarian cyst, left; salpingitis, right. Operation: April 2, 1900. Large tumor resembling ovarian cyst



found on left side, but pedicle arises from right and proved to be an enormously dilated tube weighing 300 grams, twisted once reversely to hands of watch. Ovary sclerocystic. Opposite adnexa: Ovary, normal; tube, hydrosalpinx. Bilateral salpingostomy. Result, cure.

*Praeger, J.* (Arch. f. Gyn., 1899, vol. lviii, p. 579).—*Case 1.*—Age, twenty-two. Nullipara. Suffered with delayed menses and distress in lower abdomen July, 1897. In October, 1897, ovarian tumor diagnosed; acute attack April, 1898, vomiting, constant and severe pain. Operation three months later. Diagnosis before operation: Adherent ovarian or tubal mass. Left ovary and tube removed; right ovary resected; right salpingotomy. Diagnosis: Left hydrosalpinx twisted twice in direction of hands of watch. Dark-red color; hemorrhagic infiltration. Ovary involved. Numerous adhesions.

*Case 2.*—Age, thirty-five. 1-para. No pain prior to February, 1899; thereafter, amenorrhea for twelve weeks; severe pain; constant vomiting; retention of urine. Tumor in left abdomen found. Since then great tenderness over abdomen; tumor reaching to umbilicus on left. Clinical diagnosis: Left ovarian cyst with torsion. Operation, February 23d. Tumor measures 10 x 10 x 7 cm. Diagnosis: Left hydrosalpinx, twisted twice in direction of hands of watch. Contents: Blood and bloody masses; hemorrhagic infiltration. Ovary not involved. Right side normal.

*Ries* (Amer. Gyn. and Obst. Jour., April, 1900, p. 325).—Age, thirty-two. Married. One child eleven years ago; two miscarriages, one twelve and one eight years ago. Ailing since first labor. Attack of severe pain four years ago; in bed a week. Diagnosis before operation: Inflamed right adnexa. Right tube was found to have been converted into a hematosalpinx, size of egg, which has been spontaneously amputated by torsion. Numerous adhesions. Both ovaries removed because of peri-oöphoritis.

*Rouffart, E.* (Bull. Soc. Gyn. and Obst., Brussels, 1900, tome x, No. 10, p. 257).—Age, forty. 11-para; last, eighteen months previous. Diagnosis: Retroversion of uterus. Left pyosalpinx size of orange, blackish in color. Ovary not twisted. Retroposition of uterus. Adhesions to rectum and lower portion of ileum. Right pyosalpinx adherent to rectum. Objective signs: Cervix patulous; retroversion. Tumor anterior to left of uterus, fluctuating. Subjective conditions: Menstruation began at ten years; regular; recently paroxysmal pains on left side low down. Operation: Supravaginal hysterectomy and bilateral salpingo-oöphorectomy. Result, cure.

*Rouffart* (Jour. méd. de Bruxelles, 1900, No. 12; ref. Zent. f. Gyn., 1900, vol. xxxvii, p. 975).—Age, twenty-six. 1-para. Complete separation outer part of right tube as a consequence of torsion, probably a previous hydrosalpinx; separated part adherent and parasitic; ovary adherent. Left parovarian cyst.

*Sampson, J. A.* (Amer. Jour. Obst., August, 1912, p. 271).—Case in which the symptoms pointed to an acute pelvic condition on the right side. At operation the right tube was found to be the seat of the trouble, and was twisted and enlarged to probably twice its original size. Right salpingo-oöphorectomy. The patient was nineteen years of age.

*Sänger* (Zent. f. Gynäk., 1893, No. 31, p. 727).—Age, thirty-nine. No children. For some time irregular menorrhagia and metrorrhagia. Acute pain in left adnexa. Operation after two months; no fever; vomiting. Bilateral salpingo-oöphorectomy. Left side affected. Right side inflamed; small hydrosalpinx. Diagnosis: Bilateral hydrosalpinx; Right tube size of an apple with bilateral adhesions; hemorrhagic infarction from obstructed circulation. Sänger attributed hematosalpinx and hemorrhagic necrosis in this case to the torsion.

*Siredy* (Compt. rend. de la soc. d'obst., gyn., de pæd., Paris, 1906, vol. viii, p. 150).—In discussing Martin's case, Siredy reports the following: Patient (age not given) had no symptoms whatever from genital tract. While at a watering-place, taken with enteritis; the local physician found by accident a tumor the size of adult's fist in left side. Patient had no pain or symptoms whatever, but subsequently decided to be operated on. At operation a cystic hydrosalpinx with thin walls, twisted twice, was found.

*Stark* (Jour. Obst. and Gyn. Brit. Emp., 1911, vol. xix, p. 258).—Age, forty-six. Nullipara. Attacks of pain for nine months. Clinical findings: To right of uterus, tense firm body, size of ordinary tomato; on left side, marked enlargement of the tube. At operation, blood-clots in lower abdomen and a left hematosalpinx twisted 3 times. Ovary closely applied to tube. Right dermoid cyst, intraligamentous.

*Stolz* (Monats. f. Geb. u. Gyn., 1899, vol. x, No. 2, p. 175).—Age, twenty-three. Single. Right side normal. Diagnosis: Left hydrosalpinx; diameter about 12 cm. and containing three-quarters liter of clotted blood and reddish-brown fluid. Twist, 540 degrees; slow torsion. Operation: Left salpingo-oöphorectomy.

- Storer* (Boston Med. and Surg. Jour., 1906, vol. cliv, No. 11, p. 285).—Age, twenty-nine. Married six years. No pregnancies. No history of gonorrhea. For a year dull pain in left side; recently pain before menstruation. Diagnosis before operation: Left salpingitis; right hydrosalpinx. Both tubes twisted; right side, no actual strangulation; left side, decided strangulation. Hemorrhagic infiltration and infarction on left side. Neither ovary involved. Diagnosis: Hydrosalpinx (bilateral); right twist 360 degrees, follows hands of watch; left hydrosalpinx twisted 180 degrees, direction opposite to hands of watch.
- Stratz* (Zent. f. Gynäk., 1907, No. 31, p. 1444).—Age, thirty-six. III-para; last, twelve years ago. February, 1906, after moving, profuse bleeding and pain in right side. Operation: March 22d. Diagnosis before operation: Right tubal enlargement; hydrosalpinx, pyosalpinx, or tubal pregnancy. Right side affected; left side, normal. Diagnosis: Hydrosalpinx twisted forward over round ligament and adherent to bladder. Contents partly pus. Microscopic diagnosis: Chronic salpingitis with torsion and formation of hematosalpinx. Bluish-red tumor.
- Taylor* (Trans. Brit. Gyn. Soc., Jour. Obst. and Gyn. Brit. Emp., 1893-94, vol. ix, p. 418).—Age, thirty. Married at nineteen; child at twenty. Had retroflexion and sterility for last seven years. Taylor did Alexander operation; the patient shortly after became pregnant and was confined at term. Two or three months after had abdominal pain and tumor was found. No record of histologic examination. Possibly a cyst of tube, but he says presumably a hydrosalpinx with twisted pedicle.
- Teit* (Verh. d. d. Ges. f. Gyn., 1891, vol. iv, p. 216).—Age, twenty-seven. Three children. Suffered since last labor, two years previous. Sudden attack, severe pain in abdomen; seven weeks after first attack, another; four weeks later, a tumor, reaching to umbilicus, was found. Diagnosis before operation: Torsion of ovarian cyst. Diagnosis after operation: Right hydrosalpinx twisted, filled with blood.
- Verniè* (Thèse de Paris, 1911-12, vol. xlii).—*Case 1*.—Previously reported by Martin.
- Case 2*.—Symptoms of pelvic peritonitis. Sudden onset of acute symptoms, with severe pain over affected area. Operation showed a twisted hydrosalpinx. Salpingo-oophorectomy. Recovery.
- Case 3*.—Symptoms similar in general character to Case 2. Diagnosis after operation: Torsion of a hydrosalpinx. Salpingo-oophorectomy. Recovery.
- Voigt* (Der Frauenarzt, 1909).—Age, sixty. Tumor noticed for some time; full feeling in abdomen; acute pain and tenderness. Diagnosis before operation: Large, unilocular ovarian cyst, size of man's head, twisted pedicle. Diagnosis after operation: Left hydrosalpinx twisted  $2\frac{1}{2}$  times and contained 4 liters yellow, straw-colored fluid; tumor has a dark-blue color from hemorrhagic infiltration.
- Wallo* (Amer. Jour. Obst., August, 1901, p. 179).—*Case 1*.—Age, seventeen. Acute attack; previously good health. Operation two days after onset of attack. Diagnosis before operation: Acute appendicitis. Fever; rapid pulse; tumor in right iliac fossa; vomiting. Diagnosis after operation: Right hydrosalpinx twisted 3 times; almost completely amputated by strangulation; left side, normal; no ligature needed to control bleeding from pedicle, as amputation was almost completed by the torsion.
- Case 2*.—Age, twenty-six. Married four years; never pregnant. Well until three months previous. Since then, pain low down on left side. Fever; increased pulse; pain over entire lower abdomen, especially left. Abdominal tumor immovable, but slight fluctuation, reaching from symphysis nearly to umbilicus. Diagnosis before operation: Inflamed ovarian cyst. Operation two weeks after attack. Diagnosis: Left hydrosalpinx infiltrated with blood, with several distinct and complete twists. Extensive adhesions. No villi. Ovaries and left tube normal.
- Ward, F. N.* (Amer. Jour. Obst., 1910, vol. lxiii, p. 639).—*Case 1*.—Age, forty-seven. Married twenty-one years. No children. Well until recently, except for sharp attack of pain in left ovarian region eight years before; occasional recurrence. Exciting cause of this attack, cleaning house and sweeping. Acute pain and symptoms of diffuse peritonitis. Diagnosis before operation: Ovarian cyst, twisted pedicle. Diagnosis after operation: Left hydrosalpinx twisted three times; left ovary involved; right hydrosalpinx; right ovary, normal. Free fluid blood in abdomen.
- Case 2*.—Age, twenty-two. Married four months; pregnant four months. Attack during pregnancy, characterized by nausea, vomiting, pain in lower right abdomen. Temperature,  $101^{\circ}$  F.; pulse, 140. Tender mass in right side of pelvis, beside the pregnant uterus. Presented the picture of diffuse peritonitis caused by acute appendicitis. Diagnosis after operation: Right hydrosalpinx twisted 4 times, gangrene. Blood-stained fluid present in the peritoneal cavity. Operation: Right salpingotomy, drainage. Recovery.

Waruck (Rev. Annal. de Gyn., 1894, No. 41, p. 335).—*Case 2.*—Age, thirty. III-para; first attack, six years ago; last, five months previously. Diagnosis before operation: Pyosalpinx. Diagnosis after operation: Right hydrosalpinx size of potato, torsion. Contents: Outer two-thirds, clots; inner one-third, serous fluid; small abscess in wall of outer two-thirds. Opposite adnexa healthy.

*Case 3.*—Age, forty. Nullipara. Diagnosis before operation: Bilateral ovarian cyst with twisted pedicle. Diagnosis after operation: Large right hydrosalpinx, somewhat kidney shaped, twisted  $4\frac{1}{2}$  times. Ovary not involved. Opposite adnexa: Tubo-ovarian cyst, intraligamentous.

Weir (Amer. Jour. Obst., August, 1901, p. 529).—Age, forty-six. Married; two miscarriages. Previously well. Acute attack; severe pain in right lower abdomen; nausea; difficult micturition. Diagnosis before operation: Ovarian cyst. Operation five days after. Right hydrosalpinx twisted twice. Dark red in color; hemorrhagic infiltration left side of tube and ovary adherent, otherwise ovary normal.

Williamson (Trans. Obst. Soc. London, 1905).—Age, eighteen. Unmarried. Healthy until December, 1903; from that time to June, 1904, scanty and painful menses. June 7th, severe pain in right side; later, diffuse pain, vomiting, and distention. Operation after two days. Right hydrosalpinx twisted 3 times, direction opposite to hands of watch. Contents: Blood; inner surface smooth. Ovary (right) congested, otherwise normal.

Woolcombe (Lancet, December 7, 1901, p. 1584).—Age, twenty-two. Unmarried. First attack two years before in right lower abdomen. Repeated attacks since; last one week before admission. Abdominal tumor observed for two or three months. On right side abdominal tumor extends above the umbilicus; left side also, abdominal tumor rising out of pelvis. Adhesions very easily separated. Diagnosis: Pyosalpinx (bilateral); right side with ovary twisted  $1\frac{1}{2}$  times. Left side without ovary twisted twice. Right tube, circumference,  $10\frac{1}{2}$  inches; extreme length, 8 inches; dark bluish-red blood inside. Right ovary involved; measures  $3 \times 3$  inches. Left tube, the bulbous part,  $7\frac{1}{2}$  inches long. Maximum circumference, 11 inches. Contents resemble cream cheese; no odor; no diplococci; no tubercles; no chorionic villi or signs of new-growth.

Further references to torsion of inflammatory lesions of the adnexa, the original references to which have been unobtainable, may be found in the works of Cannone,<sup>1</sup> Fassano,<sup>2</sup> and Pinard.<sup>3</sup>

The following are summaries of cases of torsion of the Fallopian tubes caused by non-gonococcal lesions:

Anspach, B. M. (Amer. Jour. Obst., October, 1912, p. 553).—Age, twenty-six. Symptoms simulating acute appendicitis. Operation revealed long, retort-shaped right tube containing blood and pus, twisted  $2\frac{1}{2}$  times in the direction of the hands of a watch. Salpingo-oophorectomy. Recovery. Subsequent to operation patient complained of pain in left ovarian region, and a few months later a second operation showed a similar shaped tube on the left side. Microscopic examination proved the latter to be tubercular in origin. The origin of the infection on the right side was probably similar, but this point could not positively be determined, because of the dense infiltration with blood and numerous hemorrhagic infarcts which were present. Recovery.

Auray (Arch. Mens. d'Obst. et de Gyn., July, 1912).—A girl fourteen years of age presented symptoms which were diagnosed as appendicitis; at operation the tube and ovary were found to be twisted twice in the direction of the hands of a clock. Salpingo-oophorectomy was performed and followed by recovery. The case is reported as one of spontaneous torsion of a normal tube and ovary.

Chaput (Rev. de Gyn., 1906, tome x, p. 963).—*Case 1.*—Age, twenty. Never menstruated. At age of seventeen symptoms of gynatresia began. Objective symptoms: Abdomen swollen, resembling myoma. On percussion, dullness; on palpation, the uterus enlarged, hard, tender, reached to about umbilicus. Lateral mass which filled

<sup>1</sup> Cannone: Anjou Méd., Angers, 1911, vol. xviii, p. 1.

<sup>2</sup> Fassano: Della torsion pedunculo sactosalpingi morgagni, Milan, 1909, vol. li, pt. 1, p. 373.

<sup>3</sup> Pinard: Compt. rend. soc. d'obstet., gyn., pæd., Paris, October, 1910.

pelvis and iliac fossa attached to uterus. Operation: Puncture of hymen, followed by discharge (1½ liters) of blackish blood. After puncture a large tumor could still be felt in the left iliac fossa. Laparotomy showed a large hematosalpinx on the right, twisted 6 times, and a small hematosalpinx on the left, twisted 5 times. Operation: Bilateral salpingo-oophorectomy. Death.

*Case 2.*—Age, eighteen. No symptoms until sixteen, then symptoms of gynatresia commenced. Objective findings: Tumor in right flank, rising to umbilicus. Operation: Vaginal section. Death. Autopsy showed hematometra. Right tube, hematosalpinx, twisted once, including mesovarium. Opposite adnexa, similar pathology, but no twists.

*London Obst. Soc.* (London Obst. Soc. Trans., 1898, vol. xl, p. 325).—The president of the London Obstetrical Society, during the discussion of Bland-Sutton's paper on tubal pregnancy, stated that he had met a case in which the mole containing tube had become twisted on its axis, with results similar to those which occur when the pedicle of a small ovarian cyst becomes twisted.

*Martin, A.* (Zeit. f. Geb. u. Gyn., 1903, vol. xxvi, p. 221).—Age, thirty-one. V-para. Pain in lower left abdomen for two weeks, making patient unfit for work. Mass size of two fists in left side of pelvis. Right adnexa normal. Diagnosis: Left tubal pregnancy, torsion and numerous adhesions, with bloody ascites. Clinical diagnosis confirmed by microscope.

*McCann* (Lancet, May 9, 1903).—Age, thirty-four. Curetage in 1898 for purulent discharge; no abnormality of adnexa at that time. Sudden seizure October, 1900. Similar attacks March, April, and May, 1901. Operation June 15, 1901. Right tube the seat of an ectopic pregnancy and twisted three times. Right ovary and opposite adnexa were normal.

*v. Merdervoort, P.* (Nederl. Tijdsch. voor verlosken Gyn., p. 175; abst. in Frommel's Jahresbericht, 1905, p. 209).—Age, twenty-four. Pain in lower abdomen for five years. At operation bilateral suppurative tubal lesions were found; the right side was twisted. Microscopically, these tubes proved to be of tubercular origin.

*Pozzi* (Compt. rend. de la soc. d'obst., gyn., pæd., Paris, 1900, vol. ii, p. 95).—Age, thirty-three. I-para (forceps). Subjective conditions: Metritis at age of twenty-eight; from time to time thereafter attacks of pain lasting two weeks, not at menstrual periods. January, 1900, very severe pains in lower abdomen. From then on several attacks of abdominal pain and constant bleeding until time of operation. Objective findings: Cervix large, soft, patulous. Uterus large; to left and in front of uterus a cyst size of fetal head; on right, slight induration. Diagnosis before operation: Ovarian cyst, left; salpingitis, right. Operation: April 2, 1900. Large tumor resembling ovarian cyst found on left side, but pedicle arises from right and proves to be an enormously dilated tube; weighs 300 grams, twisted once reversely to hands of watch. Ovary sclerocystic. Contents of tube: Fetus, 3¼ cm.; dead, not macerated. Opposite adnexa: Ovary, normal; tube, hydrosalpinx. Salpingostomy. Result, cure.

*Ross* (Amer. Jour. Obst., 1906, vol. liv, p. 653).—Diagnosis before operation: Acute appendicitis. Pain began after cranking motor car. Emergency operation. Bilateral salpingectomy. Both tubes were the seat of suppurative tubercular lesions, and the right was twisted.

*Sampson, J. A.* (Amer. Jour. Obst., August, 1912, p. 271).—Age, twenty-one. Sudden attack, simulating ovarian cyst, with torsion. Operation showed bilateral pus-tubes, with torsion on the right side. Supravaginal hysterectomy; bilateral salpingectomy. Right oophorectomy. Microscopically, the tube proved to be the seat of a tubercular infection.

*Stroganoff* (Vratch, 1893, p. 1095, quoted from Praeger: Arch. f. Gyn., 1899, vol. lviii, p. 579).—Right hydrohematosalpinx and cystic ovary. Microscopic examination showed the tube to be the seat of an adenocarcinoma twisted twice.

*Warnck* (Rev. Annal. de Gyn., 1894, No. 11, p. 335).—Age, forty-three. III-para. Diagnosis before operation: Right ovarian cyst, torsion. Diagnosis after operation: Right tubo-ovarian cyst, twisted 1½ times; left hydrosalpinx, twisted 1½ times. Microscopic examination showed both tubes to be the seat of carcinoma.

### DIFFUSE GONORRHEAL PERITONITIS

In 1886 Säger reported two cases of puerperal peritonitis that were probably of gonorrheal origin. Between 1886 and 1891 Stevens,

Loven,<sup>1</sup> Penrose,<sup>2</sup> Huber,<sup>3</sup> and Hatfield<sup>4</sup> published cases in which they believed the gonococcus to be the exciting cause. In 1891, at the meeting of the German Gynecological Society in Bonn, Wertheim<sup>5</sup> proved conclusively, as a result of carefully conducted experiments, that the gonococcus may, in some cases, produce a general peritonitis. Bumm had hitherto doubted the existence of this condition. Shortly after this Wertheim reported a case of general peritonitis in which the gonococci were recovered from the peritoneal exudate in pure culture. Owing to the rarity of diffuse gonorrheal peritonitis and the relative frequency of general infections of the peritoneum resulting from other causes, no cases should be considered authentic unless they have been so proved by a careful bacteriologic examination. The work of Cushing,<sup>6</sup> Hunner,<sup>7</sup> Wertheim,<sup>8</sup> Goodman,<sup>9</sup> and others has amply demonstrated that the gonococcus may, in some instances, produce general peritonitis. That this is a rare condition is proved by the fact that in 1907 Goodman<sup>10</sup> was able to collect only 75 cases, and of these, only 30 had been confirmed by bacteriologic examination at operation or autopsy. Diffuse gonorrheal peritonitis may occur in young girls before puberty, as a result of infection of the external genitalia or vagina, as shown by Comby<sup>11</sup> (8 cases), Northrup (2 cases), Baginsky,<sup>12</sup> Mejia,<sup>13</sup> Galvagno,<sup>14</sup> Dowd,<sup>15</sup> Koplik,<sup>16</sup> Variot,<sup>17</sup> and Cumston<sup>18</sup>; the youngest of these children was four years of age, and the oldest, twelve years. Comby's 8 cases all resulted from vulvovaginitis; 1 was mild and 7 were severe. This author states that in children the onset of gonorrheal peritonitis is extremely sudden and acute. Rolleston<sup>19</sup> believes that mild cases are often overlooked or not recognized.

<sup>1</sup> Loven, G.: Hygeia, 1886.

<sup>2</sup> Penrose: Med. News, July 5, 1890.

<sup>3</sup> Huber, F.: Trans. Amer. Med. Soc., 1890, vol. vi.

<sup>4</sup> Hatfield, M. P.: Arch. Pediat., 1886.

<sup>5</sup> Wertheim: "Zur Frage von der Gonorrhöe," Verhandlungen der deutschen Gesellschaft f. Gyn., IV. Kongress, 1891, p. 346.

<sup>6</sup> Cushing, H. W.: Johns Hopkins Hospital Bull., May, 1899, p. 75.

<sup>7</sup> Hunner: Johns Hopkins Hosp. Bull., 1899, vol. xiii, p. 247.

<sup>8</sup> Wertheim: Cent. f. Gyn., 1892, vol. xvi, p. 385.

<sup>9</sup> Goodman, C.: Amer. Jour. Dermat., October, 1911.

<sup>10</sup> Goodman, C.: Annales Surg., 1907, vol. xvi, No. 2, p. 111.

<sup>11</sup> Comby, J.: Arch. mal. d. Enfants, 1901, vol. iv, p. 513.

<sup>12</sup> Baginsky: Lehrb. der Kinderkrankheiten, 1902.

<sup>13</sup> Mejia: Abst. Cent. f. allgem. Path. u. Path.-anat., 1901, vol. xii.

<sup>14</sup> Galvagno, P.: Arch. di Pat. e clin. infant, 1903, vol. ii, Nos. 3 and 4, p. 73.

<sup>15</sup> Dowd: Annal. Surg., February, 1912.

<sup>16</sup> Koplik: Diseases of Infancy and Childhood, 3d ed., p. 571.

<sup>17</sup> Variot: Gaz. des hôpitaux, March 8, 1904.

<sup>18</sup> Cumston, C. G.: Amer. Med. Jour., 1904, vol. iv.

<sup>19</sup> Rolleston: Modern Medicine, Osler, vol. v, p. 531.



White<sup>1</sup> thinks that one of the reasons for the rarity of gonorrheal peritonitis is that the gonococci flourish best at a temperature of from 91° to 98° F., and that a higher temperature, such as would be encountered in the peritoneal cavity, inhibits its activity.

When the normal resistance of the peritoneum is diminished, a gonorrheal peritonitis is more likely to occur. The infection of the peritoneum not infrequently follows a menstrual period and the puerperium. The disease is much more frequent in women than in men, because of the anatomic location of the organs usually affected by the gonococcus. Gonorrheal peritonitis may be produced by the leakage of a pus-tube, by the torsion or rupture of an inflamed tube, or it may follow an operation performed for pelvic inflammatory disease. In rare instances cases have been recorded in which the infection has been conveyed through the lymphatic system. The anatomic lesions produced by gonorrheal peritonitis are usually slight as compared to other forms of infection in the peritoneal cavity. There is generally a uniform injection of the peritoneum, which is moderately dry. The peritoneal cavity, as a rule, contains but little pus. It is partly due to this viscid character of the exudate, which quickly produces adhesion and thus tends to confine the disease to the pelvis, that general peritonitis of gonorrheal origin is so seldom encountered.

**Symptoms.**—The symptoms are those of general peritonitis, but they are usually moderately mild. They generally appear suddenly and are severe for the first day or two, after which time, in favorable cases, they gradually subside, the entire attack varying in duration from a few days to a week or more. Usually the physical evidences of peritonitis are most marked over the lower abdomen. The disease is more fatal in children than in adults. The mortality among the former has been estimated at 20 per cent. by Galvagno.<sup>2</sup> Among the 30 cases of diffuse gonorrheal peritonitis collected by Goodman,<sup>3</sup> and which were confirmed by bacteriologic examination, 14 deaths resulted. Twenty were operated upon, with a mortality of 20 per cent. Two of these deaths cannot be ascribed to the operation nor to the gonorrheal peritonitis alone, as one case developed bronchopneumonia, and at autopsy, while gonococci were recovered from the peritoneal cavity, streptococci were found in the blood of the heart and other organs. The second case suffered from a severe empyema. If these 2 cases are excluded, the mortality is reduced to 11 per cent. for the 18 cases

<sup>1</sup> White: *System of Medicine*, Allbutt and Rolleston, 1905, vol. i, p. 855.

<sup>2</sup> Galvagno: *Arch. di Patolog. e clin. infant.*, 1904, vol. ii, Nos. 3 and 4, p. 73.

<sup>3</sup> Goodman, C.: *Amer. Surg.*, 1907, vol. xlv, No. 2, p. 111.

subjected to operative intervention. Albrecht<sup>1</sup> reports 4 cases of gonorrheal peritonitis, all of which recovered. In 2, operation was performed. In each case the onset was sudden and moderately severe. Subsidence of symptoms occurred in less time than if the infection had been caused by the ordinary pyogenic organisms. This writer agrees with Döderlein that a good prognosis may be made in gonorrheal peritonitis.

Grekow<sup>2</sup> records the histories of 2 remarkable cases of motor gastric insufficiency which he believes to have been of gonorrheal origin. Perigastritis, evidently the result of an old general gonorrheal peritonitis, was present, and resulted in spasm of the pylorus or hypertrophy and dilatation of the stomach. This observer states that the pylorus may become occluded by adhesions from without, or by a reflex spastic constriction. In either case the stomach shows evidences of great motor insufficiency, with hypertrophy of the pylorus and adhesions in its vicinity. Both the recorded cases occurred in females, one eighteen and the other twenty-two years of age.

The following is the report of 2 hitherto unpublished cases of diffuse gonorrheal peritonitis occurring in the Gynecologic Department of the University of Pennsylvania Hospital:

*Case 1.*—Colored woman, twenty-seven years of age. The patient gave a history of pelvic inflammatory disease of two months' duration. Pelvic examination revealed evidences of gonorrhea in the external genitalia and bilateral inflammatory adnexal lesions. At operation the peritoneal cavity was carefully walled off by gauze. During the course of a right salpingo-oöphorectomy and left salpingectomy about a teaspoonful of pus was discharged from the right tube into the peritoneal cavity. Both appendages were densely adherent. On the third day following the operation the patient gradually developed symptoms of general peritonitis. The temperature never rose above 102.2° F., or the pulse above 130. The abdomen was again opened, flushed with normal salt solution, and gauze drainage inserted. Cultures at this time showed the peritoneal exudate to contain gonococci in pure culture. But little free fluid was present. Convalescence was normal.

*Case 2.*—White woman, thirty years of age. This patient gave a history of pain in the lower abdomen, dysmenorrhea, dyspareunia, and irregular and profuse menstruation. Exacerbations, during which the symptoms of pelvic peritonitis were present, had occurred a number of times. During the last of these attacks the symptoms became more severe, and evidences of general peritonitis developed, and on the second day of the attack the patient was admitted to the hospital.

<sup>1</sup> Albrecht, H.: Münch. med. Woch., October 15, 1912, p. 2268.

<sup>2</sup> Grekow, I. I.: Zent. f. Chir., Leipzig, January 27, 1912, vol. xxxix, No. 4, p. 105.



At this time the abdomen was distended and tender. Her temperature was 102° F.; pulse, 126; respirations, 24. Nausea and vomiting were present. Evidences of gonorrhea were found in the external genitalia. At operation bilateral pus-tubes were found. The peritoneum was reddened and the intestines were distended. Numerous light adhesions, especially in the lower abdomen, were observed. The appendix was normal. Bilateral salpingectomy and right oöphorectomy were performed. Smears from various portions of the peritoneal cavity showed the presence of numerous diplococci, which corresponded in staining reaction and morphology to gonococci. Irrigation with normal salt solution. Gauze drainage. Recovery.

**Diagnosis.**—The diagnosis of peritonitis usually presents no great difficulty. On the other hand, positive proof that the gonococcus is the etiologic factor cannot be obtained without a bacteriologic examination of the peritoneal exudate, which is, of course, impossible until the abdomen is opened. Under certain conditions, however, the gonorrheal origin should be strongly suspected. Summarized briefly, these are the presence of gonorrhea in the genital tract and the absence of other causative agents. The abrupt onset is also somewhat suggestive. Comby<sup>1</sup> states, regarding children, that the onset of gonococcal peritonitis is absolutely "unforeseen and brutal." The degree of pain varies greatly in different cases. The symptoms are usually most marked in the lower abdomen. The temperature in adults usually denotes a somewhat milder grade of infection than is generally encountered in diffuse peritonitis of pyogenic origin. In neither of Cushing's<sup>2</sup> cases was the temperature above 100.5° F. In children the hyperpyrexia is often pronounced, the temperature not infrequently reaching 104° F. and the pulse 140 to 160. Bröse,<sup>3</sup> Cushing,<sup>4</sup> and others have remarked upon the peculiar dry, fibrinous character of the peritonitis produced by the gonococcus. In their cases there was practically no free fluid in the peritoneal cavity. These points, combined with palpable tubal lesions, should lead to a correct diagnosis in the majority of instances. In children, the presence of a vulvovaginitis should lead to the consideration of this type of infection, and on account of the frequency of gonorrheal peritonitis in the young, the vagina should always be examined in cases presenting symptoms of peritonitis.

**Treatment.**—The appropriate treatment will vary with the individual case. At the present time the general tendency, in all acute

<sup>1</sup> Comby, J.: *Arch. mal. d. Enfants*, 1901, vol. iv, p. 513.

<sup>2</sup> Cushing, H. W.: *Johns Hopkins Hosp. Bull.*, May, 1899, p. 75.

<sup>3</sup> Bröse, P.: *Berlin. klin. Wochenschr.*, 1896, vol. xxxiii, p. 779.

<sup>4</sup> Cushing, H. W.: *Johns Hopkins Hosp. Bull.*, May, 1899, p. 75.

gonorrheal conditions, is to delay operative intervention, when this can be done with safety. The surgeon must, therefore, be guided entirely by the severity of the symptoms. One of the greatest difficulties in these cases is to determine before operation the type of infection that is present. That a definite proportion of cases of diffuse gonorrheal peritonitis recover without operative interference has been amply proved. On the other hand, the dangers of non-operative treatment are many. Diffuse gonorrheal peritonitis has not infrequently been mistaken for appendicitis, and the reverse is quite possible. Operative intervention in the series of 18 cases previously mentioned resulted in only 2 deaths—certainly not a high mortality. Without operation, many women become sterile and develop pelvic lesions that, if not subsequently relieved surgically, produce chronic invalidism. In a large proportion of cases the waiting policy merely means delay in operation. If the symptoms are such as to permit delay without danger to the patient, the subsequent operation can often be performed under much more favorable conditions, and with a mortality considerably below 11 per cent. If delay is decided upon, in the interval prior to operation the patient should be placed in the upright Fowler position, and physiologic normal salt solution introduced into the rectum by the Murphy enteroclysis method. At the same time the treatment appropriate for general peritonitis should be instituted. Koltz<sup>1</sup> calls attention to the vascular paralysis, especially in the splanchnic region, which is attendant upon general peritonitis, and the heart failure which is secondary to this condition. The fall in blood-pressure and paralytic ileus and ischuria, which so frequently occur, Koltz<sup>2</sup> believes call for the exhibition of pituitrin. He reports 20 cases of general peritonitis treated with this preparation, with good results.

Further references to diffuse gonorrheal peritonitis may be found under the heading of Rupture and Torsion of Inflammatory Uterine Adnexa.

#### HYDROPS TUBÆ PROFLUENS

According to Findley,<sup>3</sup> probably the first recorded case of this condition was reported by Scanzoni,<sup>4</sup> who described a postmortem specimen in which one tube was found distended with serum and the other collapsed. That true cases of intermittent hydrosalpinx are unusual is proved by Martin,<sup>5</sup> who found but 8 cases occurring in a

<sup>1</sup> Koltz: Münch. med. Woch., September 17, 1912.

<sup>2</sup> Koltz: *Loc. cit.*

<sup>3</sup> Findley: Amer. Jour. Obst., 1906, vol. liii, p. 236.

<sup>4</sup> Scanzoni: Krankh. d. weibl. Sexual-Organ, fourth ed., vol. ii, p. 75.

<sup>5</sup> Martin: Krankheiten der Eileiter.

series of 1700 cases of salpingitis. The records of the Gynecologic Department of the University show but 3 cases occurring in a series of 925 inflammatory tubes, 141 of which were cases of hydrosalpinx.

**Etiology.**—Hydrops tubæ profluens is due to a permanent closure of the outer and a temporary occlusion of the inner end of the tube. The latter may be caused by an inflammatory swelling of the mucosa or kinking of the tube. The secretions of the tube are thus retained until the inflammation of the proximal end of the oviduct subsides sufficiently to allow the escape of the fluid into the uterus, or until the intratubal tension is sufficient to overcome the obstruction, when the kink straightens out—much in the manner of the ordinary garden hose—and allows the tube to evacuate itself. The frequency with which the tube empties itself varies greatly in different cases. Frank describes a case in which, for a period of six months, half a liter of fluid was discharged daily through the uterus. Our own cases also vary in this respect. In one case the condition had apparently been present for nearly two years, the escape of fluid occurring every four to eight weeks. In another case the tube evacuated itself much more frequently, although at irregular intervals. Bland-Sutton doubts the occurrence of this condition, believing that, in many of the cases, the fluid has its origin in the uterus. That the condition does, however, occur has been amply proved by the reports of Hennig,<sup>1</sup> Schramm,<sup>2</sup> Martin,<sup>3</sup> Doran,<sup>4</sup> and many others. Hydrops tubæ profluens should not be considered as a pathologic entity, but rather as a variety of hydrosalpinx. There seems to be no doubt that some of these cases may undergo a spontaneous cure and that in other instances the uterine end of the tube may be intermittently patulous for a time and then become permanently occluded.

**Symptoms.**—These are similar to those seen in an ordinary case of hydrosalpinx, except that in this variety of lesion there is an intermittent discharge of fluid through the uterus, which is almost invariably followed by temporary relief of symptoms. Bimanual examination at this time will reveal the tube collapsed, while at a prior or later period a fluctuant, elastic tumor will be present.

#### GONORRHEAL INFECTION OF INTRAPELVIC NEOPLASMS

Intraperitoneal gonorrhea shows a marked predilection for the pelvis, and only in rare instances does a general infection of the peritoneum result. A very unusual complication is that described by

<sup>1</sup> Hennig: *Tubenkrankh.*, Leipzig, 1876.

<sup>2</sup> Schramm: *Arch. f. Gyn.*, vol. xxxix, p. 17.

<sup>3</sup> Martin: *Krankheiten der Eileiter*.

<sup>4</sup> Doran, A.: *System of Gynecology*, vol. xxxix, p. 17.

Brettauer,<sup>1</sup> who reports a case in which a gonorrheal infection took place in a large unilocular ovarian cyst. The microorganisms were recovered from the distal end of the Fallopian tube, from the uterine cavity, and from the contents of the cyst. Following removal of the cyst the patient made a normal recovery. Confrontation in this case proved that the patient's husband was suffering from an acute attack of urethritis. Repeated efforts, both before and after operation, to demonstrate the presence of the gonococcus failed to reveal the specific microorganism in the external genitalia of the wife, and while at operation the organisms were recovered from the Fallopian tube, macroscopically the latter organ was normal. Clinically, this case presented symptoms not unlike those produced by torsion.

#### MIXED INFECTION

A mixed infection, *i. e.*, gonococci and other organisms, such as the tubercle bacilli, is by no means uncommon. It is impossible, in many cases, to determine whether the gonorrheal condition is superimposed upon the tuberculous or if the reverse is the case. Most authorities, however, believe that the latter is the more frequent condition, and that once the tubal mucosa is altered by a gonorrheal inflammation an excellent soil for the development of the secondary infections is prepared. In the Pathologic Laboratory of the University of Pennsylvania 31 cases of tuberculosis of the tubes have been examined by the author. In 20 of these the histories seemed to cover this point; 6 of these have apparently been associated with clinical evidences of gonorrhea. Owing to the fact that bacteriologic tests have not been performed upon the majority of these cases, it is impossible definitely to determine this point. The possibility of tuberculosis accompanying gonorrheal lesions of the adnexa should be weighed, and due precautions taken in making the prognosis and in instituting treatment in such cases.

Cultures taken from cases of gonorrhea early in the acute stage usually show an unmixed infection, but when the disease becomes chronic and has been of long standing, mixed or, as Menge properly terms them, secondary infections, are frequently encountered. This point is of importance when employing the vaccine or serum treatment. Gonorrheal lesions of the adnexa often contain colon bacilli or other organisms. It seems probable that the gonococcus not infrequently prepares the soil for the streptococcus or other pyogenic organisms.

<sup>1</sup> Brettauer: Amer. Jour. Obst., 1908, vol. lvii, p. 411.

## GONORRHEA AS THE ETIOLOGIC FACTOR IN THE CAUSATION OF ECTOPIC PREGNANCY

The fact that inflammation of the oviducts is often a forerunner of tubal pregnancy, and that salpingitis is one of the most frequent causative agents in the production of tubal gestation, is now generally appreciated. Fehling<sup>1</sup> reports the results obtained in 170 cases of early extra-uterine pregnancy, in nearly half of which, when a careful examination was possible, the opposite adnexa were found diseased. He also states that in 54 of 143 cases the lesions were so extensive as to make a bilateral salpingectomy necessary. This observer dwells strongly upon gonorrhea as a predisposing factor in the production of tubal pregnancy.

Cones<sup>2</sup> states that an analysis of 202 cases of extra-uterine pregnancy occurring in the Massachusetts General Hospital showed that over 83 per cent. of these cases were accompanied by inflammatory lesions of the tubes or ovaries. Meyer<sup>3</sup> found that in a series of 44 cases of tubal pregnancy more than 33 per cent. gave an antecedent history of gonorrhea. During the past twelve years 64 cases of tubal pregnancy have been operated upon in the Gynecologic Department of the University Hospital. Of these, 18 were in all probability associated with or preceded by gonorrhea. Twenty additional cases presented pelvic lesions which, upon histologic examination, strongly suggested the presence of a gonorrheal infection.

## GONORRHEA AS A PREDISPOSING FACTOR TO CARCINOMA

Primary carcinoma of the Fallopian tube is a rare disease. Until 1909 only about 86 authentic cases of this condition were on record.<sup>4</sup> Pathologists generally agree that inflammation is a predisposing factor to the production of carcinoma of the tube. The 4 cases which the author has had the opportunity of examining all showed positive evidence of preëxisting inflammation. Rossinsky<sup>5</sup> has recently reported in detail a case of primary carcinoma of the tube which he attributes to a previous gonorrhea. The tumor developed on the site of an old salpingitis. The relation which a preëxisting endometritis may bear to the subsequent development of carcinoma is undetermined. Cullen<sup>6</sup> states that he has examined the mucosa in 19 cases of car-

<sup>1</sup> Fehling, H.: *Arch. f. Gyn.*, vol. xcii, No. 1.

<sup>2</sup> Cones, W. P.: *Boston Med. and Surg. Jour.*, 1911, vol. clxiv, p. 677.

<sup>3</sup> Meyer, F.: *Australian Med. Jour.*, February 17, 1912.

<sup>4</sup> Norris, C. C.: *Surg., Gyn., and Obst.*, March, 1909, p. 272.

<sup>5</sup> Rossinsky, T.: *Inaug. Dissert.*, Basel, 1910.

<sup>6</sup> Cullen, T. A.: *Cancer of the Uterus*, 1900, p. 652, D. Appleton & Co., N. Y.

cinoma of the body of the uterus, and found only 2 in which there were any definite evidences of endometritis. He adds, however, that from the study of the material at his disposal he has not been able to arrive at any definite conclusion regarding this point. Theilhaber<sup>1</sup> believes that chronic gonorrheal inflammation of large areas in the uterine mucosa and adnexa are predisposing factors to the development of carcinoma, causing interference with the nutrition of the parts, as well as by the direct irritant action of the discharges.

#### HERNIATED INFLAMMATORY ADNEXA

The fact that a tube or ovary is the seat of an inflammation tends to prevent it from prolapsing into a hernial sac, the adhesions usually holding it in position. Cullen<sup>2</sup> has, however, recorded a case in which the left tube and ovary were removed for adnexitis. Later the patient developed an appendiceal abscess, which it was necessary to drain. A hernia developed in the appendectomy wound. At a subsequent date a tender mass could be palpated in the hernial sac. At operation this proved to be a hydrosalpinx and an adherent ovary. Goepel<sup>3</sup> has reported a case in which a pyosalpinx was found. From the description, however, it would appear that this specimen might quite readily have been a hydrosalpinx in which, as a result of interference with the blood-supply incident to location within the hernial sac, suppuration had occurred. Le Nouëne<sup>4</sup> has also recorded the history of a case in which a hernia contained both tubes and ovaries, the adnexa on the left side being the seat of a suppurative lesion. In none of the cases just described is the type of infection recorded.

#### ESTHIOMENE AND ELEPHANTIASIS

In 1903 Szasz<sup>5</sup> reported the history of a remarkable case of elephantiasis of the external genitalia which was apparently secondary to or developed upon the site of a preëxisting gonorrhea. A rectal stricture and gonorrheal proctitis were present. On microscopic examination the labia presented a typical picture of elephantiasis. The secondary characteristics were manifest in the enormously dilated lymph-vessels. Sections from the peripheral portions contained small cysts that could be seen with the naked eye. These contained clear lymph. The cysts were lined by a simple layer of

<sup>1</sup> Theilhaber: *Arch. f. Gyn.*, Berlin, 1912, vol. xevi, No. 3.

<sup>2</sup> Cullen: *T. S.: Johns Hopkins Hosp. Bull.*, May, 1906, p. 152.

<sup>3</sup> Goepel: *Zentralbl. f. Chir.*, 1896, vol. xxiii.

<sup>4</sup> Le Nouëne: *Gaz. de Gyn.*, 1903, vol. xv, p. 337.

<sup>5</sup> Szasz: *Monats. f. Geb. u. Gyn.*, 1903, p. 999.





FIG. 36.—CARCINOMA WHICH OCCURRED IN THE FALLOPIAN TUBE OF A YOUNG WOMAN.

The carcinoma has been implanted upon a preexisting inflammatory lesion. The cross-section of the tube shows the papillary character of the carcinoma. The left tube is the seat of a pyosalpinx. Both ovaries show cystic change and numerous adhesions. (For full report of this case see *Surgery, Gynecology, and Obstetrics*, March, 1909.)



FIG. 37.—CARCINOMA OF THE FALLOPIAN TUBE (HIGH AND LOW POWER).

The surface shows adhesions. The muscularis is somewhat thickened and fibrous, and at some points is infiltrated with groups of carcinomatous cells. Evidences of preexisting inflammation, characterized by chronic inflammatory exudate and numerous plasma-cells, are everywhere present. The high power shows the usual characteristics of carcinoma (*Surg., Gyn., and Obst.*, March, 1909.)





endothelium. Stein and Heilmann<sup>1</sup> record the history of a case of esthiomene of the external genitalia that seems to have been secondary to gonorrhea. Over both labia, but most marked on the right side, and about the anus were numerous macules, papules, and cysts, varying in size from that of a pin-head to a kidney-bean. These were isolated or grouped, and those that were cystic contained a limpid alkaline fluid. Here and there superficial ulcerations were present. The condition was chronic, and the tumors were not sensitive. The patient had a rectal stricture. The authors state that they found the causal factor to be, in the first place, the chemical irritation of the discharge from the rectum, and, in the second place, the rectal stricture, both presumably due to an earlier rectal gonorrhea. On purely mechanical grounds the lymphatic stasis would account for all clinical and pathologic features of the case except the original ulceration.

<sup>1</sup> Stein, A., and Heilmann, W. J.: Surg., Gyn., and Obst., April, 1912, p. 345.

## CHAPTER XV

### GONORRHEA IN PREGNANCY, LABOR, AND THE PUERPERIUM

As has been mentioned in a previous chapter, gonorrhea is a frequent cause of sterility. Sterility may be produced in the woman by gonorrheal lesions of the external genitalia or vagina, which cause severe dyspareunia, by gonorrheal cervicitis or endometritis, or by affections of the tubes or ovaries. If the tubes are occluded or the ovaries are so diseased that follicles cannot mature or rupture, conception is, of course, impossible, but with these exceptions pregnancy may occur in the female gonorrheic. Under such circumstances pregnancy may be interrupted as a result of the direct action of a decidual endometritis or other intrapelvic lesions, or the gestation may proceed to term. The gonococcus has been demonstrated in the decidua by Neumann,<sup>1</sup> Maslowsky,<sup>2</sup> Williams,<sup>3</sup> Krönig,<sup>4</sup> and others as the active cause of inflammation and abortion in a large series of cases. Gonorrhea may precede pregnancy or may be contracted during gestation. The last authority was the first definitely to prove the existence of gonorrheal deciduitis. Krönig cultivated the gonococcus from 9 cases, all of which presented mild clinical symptoms. Cases have been seen in which a woman has become infected with gonorrhea at the time conception took place. Impregnation seldom occurs after the infection has extended above the internal os.

The influence of pregnancy on the course of gonorrhea is usually quite marked. Pregnant women are, as a result of the increased blood-supply of the genital organs and the softening of these structures incident to gestation, more receptive to gonorrheal infection than their non-gravid sisters. For similar reasons, previously latent gonorrhea is particularly likely to become active during the course of gestation, and extension to the hitherto normal endometrium and appendages is frequent. Similar histologic and anatomic changes occur, but to an exaggerated degree, in the genital tract during pregnancy as are found during menstruation, a period when extension to the endometrium and adnexa is particularly prone to take place. This is proved

<sup>1</sup> Neumann: *Monats. f. Geb. u. Gyn.*, April, 1896.

<sup>2</sup> Maslowsky: *Ibid.*, 1896, vol. iv, No. 3.

<sup>3</sup> Williams, J. W.: *Amer. Jour. Obst.*, 1899, vol. xxxix, p. 289.

<sup>4</sup> Krönig: *Cent. f. Gyn.*, 1893, p. 157.

by the large proportion of tubal lesions that are encountered in pregnant women, the extension in many of these necessarily having occurred after conception, as the oviducts are frequently found occluded.

A marked amplification of the symptoms of the infection are particularly likely to occur during the latter months of pregnancy.

Gonorrhea is extremely frequent during pregnancy. Gurd<sup>1</sup> isolated the gonococcus in 52 out of 113 pregnant women applying for treatment for pelvic pain at a dispensary. Leopold<sup>2</sup> estimated that 20 per cent. of pregnant women had gonorrhea. Stephenson<sup>3</sup> states that, among 1101 pregnant women, the gonococcus was demonstrable in 18.43 per cent. Fruhinsholz<sup>4</sup> believes that gonococci are present in from 20 to 25 per cent. of pregnant females. Zwow<sup>5</sup> found gonococci in 75 of 130 pregnant women. Sanger,<sup>6</sup> Burekhardt,<sup>7</sup> and Lomer<sup>8</sup> place the figure at between 15 and 30 per cent. More recent observers, such as Taussig,<sup>9</sup> Harrar,<sup>10</sup> and others, state that about 5 to 10 per cent. of parturient women have gonorrhea. The latter conservative estimate is probably the more correct, as most of the earlier statistics are based only upon dispensary patients, a class of women in whom gonorrhea is relatively frequent.

Further studies confirming the frequency of gonococci as the etiologic factor in the production of puerperal infection may be found in the works of Schottmuller,<sup>11</sup> Bundy,<sup>12</sup> Goldschmidt,<sup>13</sup> and many others.

**Symptoms.**—These differ according to the lesions that are present, and are similar to those seen in gonorrhea in the non-pregnant state, except that the disease is likely to be more severe and progressive in type. Condylomata especially exhibit active growth, and if these tumors are present, their large size, vascular appearance, and rapid increase in bulk are frequently marked features of the case. If the infection extends to the endometrium, abortion may occur. Arthritis,

<sup>1</sup> Gurd, F. B.: Montreal Med. Jour., 1908, vol. xxxvii, p. 798.

<sup>2</sup> Leopold: Arch. f. Gyn., 1893, vol. xlv, p. 667.

<sup>3</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 38.

<sup>4</sup> Fruhinsholz: Ann. de Gyn., October and November, 1902.

<sup>5</sup> Zwow, J.: Rev. gen. d'ophtalmologie, 1888, p. 28.

<sup>6</sup> Sanger: Zeit. f. Geb. u. Gyn., 1886, p. 177.

<sup>7</sup> Burekhardt: Beitrage z. Geb. u. Gyn., 1889, vol. ii, p. 2.

<sup>8</sup> Lomer: Zeit. f. Geb. u. Gyn., 1884, vol. x, p. 336.

<sup>9</sup> Taussig: Amer. Gyn., 1903, vol. ii, p. 334.

<sup>10</sup> Harrar, J. A.: Bull. Lying-in Hosp., New York, March, 1911, p. 166.

<sup>11</sup> Schottmuller: Munch. med. Woch., March 14, 1911.

<sup>12</sup> Bundy: Cent. f. Gyn., February 25, 1911.

<sup>13</sup> Goldschmidt: Arch. f. Gyn., vol. xciii, No. 2.

endocarditis, general peritonitis, and other complications are more likely to take place than if pregnancy were not present.

**Diagnosis.**—The diagnosis of gonorrhea at this time presents no especial difficulties, and the same methods may be employed as have previously been described in an earlier chapter.

**Treatment of Gonorrhea During Pregnancy.**—The same general principles should be adopted in the treatment of the pregnant gonorrheic as are followed in the non-pregnant patient. Especial care should be taken, however, to prevent the extension of the disease, and, if the infection is confined to areas below the internal os, entirely to eradicate the gonorrhea before the termination of pregnancy. With this end in view an active and systematic course of treatment should be instituted. Care must be taken, however, to avoid inducing an abortion. For this reason all cervical manipulations and treatments should be performed with the greatest gentleness possible. The introduction of powerful antiseptics far into the cervical canal, or wide dilatation of this organ, is contraindicated for the same reason. The maintenance of the strictest asepsis is necessary in the treatment of these patients. Examinations should be gently performed and rest and the absolute interdiction of sexual intercourse and all forms of violent exercise should be counseled. Operative procedures are to be avoided whenever possible on account of the dangers of premature expulsion of the fetus and the possibility of spreading the infection. If it becomes apparent that abortion or miscarriage is inevitable, then such prophylactic measures as will be described under the Conduction of Labor in Gonorrheics are indicated.

#### GONORRHEAL PUERPERAL INFECTION

To Krönig<sup>1</sup> is due the credit for having been the first to adduce positive bacteriologic proof of the pathologic action of the gonococci during the puerperium. This microorganism plays an important part in the production of puerperal infection. Sängér<sup>2</sup> states that even under the most favorable circumstances, 15 per cent. of women suffering from gonorrhea at the time of delivery develop puerperal infection, the usual type of lesion being an inflammatory condition of the adnexa. Gurd<sup>3</sup> and others are of the opinion that the gonococcus not only frequently produces infection at this time, but, by its presence, is a strong predisposing factor in the production of streptococcic or other form of sepsis. The normal vaginal, urethral, and cervical epithelium is not often attacked by the ordinary pyogenic cocci. When,

<sup>1</sup> Krönig: *Cent. f. Gyn.*, 1893, p. 675.    <sup>2</sup> Sängér: *Centralbl. f. Geb. u. Gyn.*, 1886, p. 177.

<sup>3</sup> Gurd, F. B.: *Montreal Med. Jour.*, 1908, vol. xxxvii, p. 798.

however, the resistance of these parts is lessened or overcome by the gonococcus, other bacteria seem able to produce their characteristic lesions. Gurd<sup>1</sup> believes that this accounts, to a great extent, for the diversity of opinion held by various authorities upon the question of auto-infection. Among 14 cases of infection following abortion, miscarriage, or labor, Gurd<sup>2</sup> found the gonococcus present 5 times and 4 times associated with the streptococcus. Stephenson<sup>3</sup> states that of 354 cases of puerperal infection, 14.763 per cent. were due to the gonococcus. Krönig<sup>4</sup> demonstrated the gonococcus in 50 out of 179 cases of puerperal infection; Taussig,<sup>5</sup> in 17 per cent.; Vogel,<sup>6</sup> in 16 per cent.; Stone and McDonald,<sup>7</sup> in 33 per cent.; Bumm,<sup>8</sup> in 7 per cent., and Williams,<sup>9</sup> in 5 per cent. On the other hand, Foulerton and Bonney<sup>10</sup> believe that undue prominence has been given to the gonococcus in the etiology of sepsis. These authors examined 54 cases of puerperal sepsis without finding the gonococcus.

**Symptoms.**—These may arise as the result of an infection with the gonococcus at or immediately before or after labor in a previously healthy woman, the microorganism being introduced from without, on instruments or by the examining hand, or more frequently it may result from an extension upward of a cervical gonorrhea or an exacerbation of a latent endometritis or adnexitis. Lea<sup>11</sup> states that if gonorrhea of the external genitalia is present, extension to the endometrium is likely to occur after labor or abortion. According to Krönig,<sup>12</sup> Natvig,<sup>13</sup> and Wegelius,<sup>14</sup> certain varieties of microorganisms from the vulva frequently ascend into the vagina in the days immediately subsequent to delivery. Pilz<sup>15</sup> and Natvig<sup>16</sup> have shown that these bacteria are usually innocuous. Gonorrheal infection, however, cannot be accounted for in this manner, as the gonococcus is non-motile. Infection from the external genitalia, therefore, occurs only as a result of the introduction of the gonococcus into the vagina during the manipulations incident to the care of the patient. In most cases, however, the cervix is already involved. One of the chief character-

<sup>1</sup> Gurd, F. B.: *Montreal Med. Jour.*, 1908, vol. xxxvii, p. 798.

<sup>2</sup> Gurd, F. B.: *Ibid.* <sup>3</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1908, p. 38.

<sup>4</sup> Krönig: *Cent. f. Gyn.*, 1895, p. 409. <sup>5</sup> Taussig: *Amer. Gyn.*, 1903, vol. ii, p. 334.

<sup>6</sup> Vogel: *Zeitschr. f. Geb. u. Gyn.*, Stuttgart, 1901, vol. xlv, p. 412.

<sup>7</sup> Stone and McDonald: *Amer. Jour. Obst.*, 1906, vol. liii, p. 251.

<sup>8</sup> Bumm: *Cent. f. Gyn.*, 1899, No. 11, p. 289.

<sup>9</sup> Williams, J. W.: *Amer. Jour. Obst.*, 1899, vol. xxxix, p. 289.

<sup>10</sup> Foulerton, A. G. R., and Bonney, V.: *Trans. Obst. Soc.*, London, 1905, vol. xlvii; also *Lancet*, London, 1905, vol. i, p. 915.

<sup>11</sup> Lea: *Puerperal Infection*, 1911.

<sup>12</sup> Krönig: *Cent. f. Gyn.*, 1895, p. 409.

<sup>13</sup> Natvig: *Arch. f. Gyn.*, 1905, vol. lxxvi.

<sup>14</sup> Wegelius: *Arch. f. Gyn.*, vol. lxxxviii.

<sup>15</sup> Pilz: *Arch. f. Gyn.*, vol. lxxii, p. 537.

<sup>16</sup> Natvig: *Arch. f. Gyn.*, 1905, vol. lxxvi.

istics of a pure gonorrheal puerperal infection is the lateness of the onset of the symptoms. The period of incubation in the uterus or appendages is of the same duration as in other portions of the body; therefore, as a result, in this type of infection definite symptoms rarely develop before the third day, and often not until the latter part of the first week—sometimes even later. Occasionally, when the infection has extended above the internal os before the onset of labor, the temperature rises shortly after delivery.

The lochia is foul and has a fetid, musty odor; the pulse and temperature range somewhat lower and the patients do not look so ill as when a streptococcic infection is present. The acute symptoms usually disappear in from five days to ten days. According to Harrar,<sup>1</sup> further trouble may be expected in 12 per cent. of such cases. The author believes that this percentage should be at least doubled.

Menge<sup>2</sup> describes a form of late puerperal gonorrheal endometritis that occurs between the sixth and seventeenth week of the puerperium, and is usually coincident with the first menstruation or ovulation. The earliest manifestations of infection are often malaise, headache, and a slight pyrexia. Occasionally nausea or vomiting is present. The temperature rarely rises above 101° or 102.5° F. at any stage of the disease. Indeed, Bumm<sup>3</sup> states that high temperature is a certain indication of the presence of microorganisms other than the gonococcus. Smith<sup>4</sup> has, however, recorded 2 extremely severe cases, in one of which the temperature on several successive days reached 107° F. Such extremely high temperatures are very rare.

The pulse-rate, although increased, is rarely correspondingly rapid, unless as the result of the weakness incident to the loss of blood. The temperature and pulse tend to run an even course, and the marked evening rise and morning remission, so characteristic of the more virulent forms of puerperal infection, are absent. The coated tongue, the fetor of the breath, the anorexia, and the other manifestations of fever are usually present. The urine is frequently diminished in amount, of high specific gravity, and often contains a trace of albumin. The bowels are usually constipated, but diarrhea may be present. If the infection is prolonged, as in neglected cases, the patient loses flesh and strength, and the various functions of the body become more or less impaired. Pain over the lower abdomen is always present. The severity of the symptoms naturally varies with the individual

<sup>1</sup> Harrar, J. A.: *Bull. Lying-in Hosp.*, New York, March, 1911, p. 166.

<sup>2</sup> Menge, K.: *Handb. der Geschlechtskrankheiten*, Vienna, 1910.

<sup>3</sup> Bumm: *Cent. f. Gyn.*, 1899, No. 11, p. 289.

<sup>4</sup> Smith, J. T.: *Cleveland Med. Jour.*, October, 1911, p. 810.



case, but are, as a rule, much milder than in the streptococci or other varieties of puerperal infection. The milk secretion is usually diminished, and if the fever is high, may be entirely suppressed. The lochia becomes purulent, and varies in color from a yellowish-white to a deep chocolate color, according to the amount of admixture of blood, and is increased in quantity, and thick, glairy, or creamy in character. In some cases, owing to retention in the uterus, the lochia is temporarily diminished. At these periods the temperature usually rises. Gonococci can be demonstrated in the discharge. Evidence of gonorrhea can generally be found in the external genitalia and in the cervix. The cervical canal is often widely dilated, and involution is retarded; the uterine walls are relaxed, tender, and the organ is bulkier than normal. In the anabasis of the disease it is rarely possible to palpate the appendages accurately without an anesthetic; marked tenderness is likely to be present in one or both ovarian regions.

**Diagnosis.**—Gonorrheal puerperal infection must be distinguished from the various other conditions that produce pyrexia during the puerperium, among the most frequent of which are mammary complications, auto-intoxication resulting from constipation, especially after a cathartic has been administered and before the bowels have moved; retained secundines and other forms of infection, such as the streptococcus, staphylococcus, or colon bacillus. Appendicitis, torsion of the pedicle of tumors, typhoid fever, malaria, tuberculosis, and the infectious fevers in general can all usually be excluded without great difficulty. Malaria in particular is often made the scapegoat in puerperal infection. It is hardly necessary to state that a diagnosis of malaria is not justifiable unless the plasmodium can be demonstrated in the blood of the patient. Postpuerperal pyrexia should always be considered of infectious origin until it can be proved otherwise. Late onset of symptoms, slow, regular pulse, steady, moderate fever, and profuse purulent lochia, are all suggestive of gonorrheal infection. If the anamnesis is carefully inquired into, it will be found that most cases present a history suggestive of a previous gonorrheal infection. In married women a history of urethritis in the husband is often obtainable. Bacteriologically, gonococci can almost invariably be recovered from various portions of the genital tract. In this connection, however, it should be remembered that the demonstration of the gonococcus does not preclude the presence of other microorganisms. In 4 of Gurd's<sup>1</sup> 5 cases the microorganism was associated with the streptococcus. Uterine cultures made by an

<sup>1</sup> Gurd, F. B.: Montreal Med. Jour., 1908, vol. xxxvii, p. 798.

experienced bacteriologist who employs the Nicholson tube are of great value in doubtful cases.

**Prognosis.**—This varies widely in different cases. The acuteness of the infection is largely dependent upon the receptivity of the particular patient. In some cases the type of infection is mild, the patient's resisting powers strong, and the acute symptoms may not last for more than a few days; whereas in others the attack continues for a long period and exacerbations are frequent. If there has been marked loss of blood during or following labor, the prognosis is less favorable. Subsidence usually occurs gradually. Webster<sup>1</sup> states that embolism sometimes occurs. Death may result from a variety of complications, but the gonococcus alone rarely causes a fatal termination. A high temperature, and especially a high pulse-rate, or other grave symptoms usually indicate the presence of microorganisms other than the gonococcus. Bandler<sup>2</sup> states that postpartum infections are often mild. The heritage of the majority of these patients is the semi-invalidism incident to chronic pelvic inflammatory disease and its accompanying sterility.

**Prophylactic Treatment.**—This consists of adopting prophylactic measures before and during labor. Both clinical and experimental work has shown that the routine employment of the prophylactic antepartum vaginal douche is not only useless, but even directly harmful. This procedure has, therefore, been abandoned by most obstetricians. When, however, gonorrhea is present in the uterus or lower genital tract, practically all authorities agree that vaginal irrigations are indicated unless the infection is limited to the vulva and urethra. In gonorrheal cases at the Sloane Maternity, Cragin<sup>3</sup> directs the administration of a daily douche consisting of bichlorid 1:5000 during the last week of pregnancy, and as soon as labor commences a vaginal irrigation of 0.5 per cent. solution of lysol. Williams<sup>4</sup> employs copious douches of hot bichlorid solution 1:10,000 twice daily during the last few weeks of pregnancy. These douches are administered not so much in the hope of curing the disease, as of avoiding infection of the child's eyes during labor.

If gonorrhea is present in the external genitalia, these structures, and even the vagina and cervix, may be painted with iodine solution as soon as labor commences. This obviates the necessity of washing the parts with antiseptic solutions. The skin should be

<sup>1</sup> Webster, J. C.: *Diseases of Women*.

<sup>2</sup> Bandler, S. W.: *The Post-Graduate*, April, 1912, p. 264.

<sup>3</sup> Cragin: *Amer. Jour. Obst.*, 1906, vol. liii, p. 776.

<sup>4</sup> Williams, J. W.: *Obstetrics*, 1903.

absolutely dry before the application of the iodine, as previous wetting of the skin tends to cause swelling of the surface epithelium and prevents the penetration of the iodine to the deeper layers and into the crypts and glands. Within the vagina or in areas that are normally moist this is not the case, as the surface cells in such localities are, as it were, accustomed to moisture, and do not enlarge, and, as a result, iodine can be effectively employed. The most suitable strength of iodine to employ for this purpose is a 50 per cent. solution of the official tincture, the dilution being made with absolute alcohol. The writer has, however, frequently applied the full-strength official tincture, and only in a small proportion of such cases was a noticeable irritation produced. If, however, more than one application is made, subsequent inconvenience is likely to be experienced by the patient unless the solution is diluted.

If, before labor, the infection has been confined to areas below the internal os, every effort should be made during the process of delivery to avoid contamination of the uterine cavity. For this reason all intra-uterine manipulations should be avoided when possible. Postpartum vaginal douches of 1:5000 bichlorid solution, followed by sterile water or physiologic salt solution, should be administered once or twice daily with the patient in the upright Fowler position. The douche should be given slowly, and every effort be made to prevent the solution from entering the uterine cavity. The douche nozzle should have openings in the sides only, as otherwise a stream of fluid may be directed into the cervix. Some authorities recommend the insertion of a temporary tampon against the cervix prior to the administration of the douche, for the purpose of walling off the cervical canal.

Lesions of the external genitalia should receive appropriate treatment. If the infection has previously been confined to the external genitalia, the proper drainage of the vagina is, at least, of theoretic advantage, as without intravaginal manipulations or gravity the non-motile gonococcus is unlikely to reach the cervix. Unfortunately, in the large majority of cases the cervix is already contaminated, and infection to the endometrium can easily occur by continuity.

When the child's head is born, or soon afterward, its eyes should be treated by the Credé method of prophylaxis for ophthalmia, and other methods adopted to prevent infection of the infant's eyes, which will be described in detail in a subsequent chapter.

#### **Curative Treatment of Puerperal Infection of Gonorrheal Origin.—**

In most cases of postpuerperal infection of the genital tract the author believes that it is the duty of the obstetrician to ascertain if the

uterine cavity is empty. This may be performed with the hand introduced into the vagina and the fingers in the uterus, as recommended by Polak,<sup>1</sup> or the placental forceps may be employed. In any event, no curetage should be performed. The removal of retained secundines is all that is indicated, and this should be performed with as little trauma as possible. With a well-contracted uterus, a closed cervix, and no foul discharge or bleeding, the uterus should not be entered, as such conditions practically preclude the possibility of retained secundines. No greater mistake can be made than to employ routine curetage in these cases.

It should be remembered that after labor or abortion the gonococcus usually produces localized lesions, and for this reason operative intervention during the acute stage is most unwise, unless pus can be evacuated without traversing the peritoneal cavity, or in those rare cases in which general peritonitis develops. It cannot be too strongly urged that operative treatment in the ordinary case of gonorrheal puerperal infection is contraindicated during the acute stage of the disease. These cases, even if untreated, rarely proceed to a fatal termination, and all that has been said under the heading of *The Selection of the Time to Operate on Cases of Pelvic Inflammatory Disease* is true regarding these patients. The treatment during the acute stage should consist of a carefully regulated, alcohol-free diet, which, if the temperature is above 100.5° F., should be chiefly liquid. Cold sponges may be employed for fever. Regulation of the bowels, application to the lower abdomen of heat or cold, and slow administration of copious vaginal irrigations, with the patient in the upright Fowler position, are all indicated. Postural drainage, secured by maintaining the patient in the upright Fowler position, is of much benefit. If the pain is severe, opium or its derivatives may be required. Further medication is, as a rule, unnecessary. In protracted cases, or in those in which there is cardiac or general weakness, strychnin is beneficial. As the acute symptoms tend to subside the diet should be augmented, and a tonic containing iron, arsenic, or nux vomica should be prescribed. It should be borne in mind that these patients are strictly surgical cases, and that operative intervention may be required at any time. For this reason patients are best treated in a hospital, where they can be under constant and careful supervision. The frequency of the pelvic examinations will necessarily vary with the individual cases, but should, however, be made only sufficiently often

<sup>1</sup> Polak, J. O.: *Surg., Gyn., and Obst.*, July, 1911; also *Jour. Amer. Med. Assoc.*, August 31, 1912, p. 707.

to keep the surgeon acquainted with the intrapelvic changes that are taking place. To safeguard others, the nurse and sometimes the patient should be warned of the infectious nature of the leukorrhea. Under no conditions should the child be allowed to sleep in the same bed with the mother, as under such circumstances the danger of it contracting an ophthalmia, or, if it is a girl, a vaginitis, is very great.

**The Indications for Operation During the Acute Stage.**—These may be briefly summarized. When it is possible to evacuate pus without traversing the peritoneal cavity, as in cases in which an abscess tends to point in the neighborhood of the inguinal canal or in the vagina, operation may be undertaken. Such collections should be incised, evacuated, and packed with sterile gauze. Immediate operation is also generally indicated if a diffuse peritonitis develops. Finally operation may be required in extremely protracted cases that show no tendency to improve under the palliative treatment. Such cases are seldom encountered.

## CHAPTER XVI

### GONORRHEA IN THE EXTREMES OF LIFE

#### GONORRHEA IN CHILDREN

THE gonococcus is the most frequent etiologic factor in the production of inflammatory diseases of a gynecologic nature occurring in children.

**Vulvovaginitis.**—In the Johns Hopkins Hospital Dispensary Hurdon<sup>1</sup> found the gonococcus in 63 per cent. of all cases of vulvitis in children. Among 24 cases of vulvovaginitis Koplik<sup>2</sup> was able to demonstrate the gonococcus in 17. Romniceanu and Robin<sup>3</sup> report 150 cases of vaginitis, of which 130 were of gonorrheal origin. Dukelski<sup>4</sup> found the gonococcus in 80 per cent. of his cases. Plomley<sup>5</sup> was able to demonstrate the organism in 85.7 per cent. of a series of 42 female children who had a leukorrhea. Welt-Kakels<sup>6</sup> states that the majority of the 190 cases observed by her at the Mount Sinai Hospital Dispensary were due to this cause. A similar statement is made by Pollack.<sup>7</sup> Gonorrhea is comparatively infrequent among female children of the better class, but among the poor and those comprising the general run of ward patients this variety of infection is extremely prevalent. Indeed, Holt<sup>8</sup> states that it occurs in from 2 to 10 per cent. of all inmates of institutions, such as day nurseries, homes for foundlings, asylums, and children's wards of general hospitals. Kimball<sup>9</sup> found, among 600 children admitted to the public ward of the Babies' Hospital, New York, 70 cases of gonorrheal vulvovaginitis. Hamilton states that 4 per cent. of all the applicants to the same institution were found to have gonorrheal vulvovaginitis. Pott<sup>10</sup> observed 86 cases among 3921 girls.

Epidemics are frequent. Four epidemics were observed by Holt<sup>11</sup>

<sup>1</sup> Hurdon, E.: Kelly and Noble: Gyn. and Abdom. Surg., 1907, vol. i, p. 811, first ed.

<sup>2</sup> Koplik: Jour. Cutan. and Gen.-urin. Dis., 1893, vol. ii.

<sup>3</sup> Romniceanu and Robin: Wien. med. Presse, 1901, vol. xlii, No. 43, p. 1970.

<sup>4</sup> Dukelski: Jahrb. f. Kinderheilk., 1904, vol. lix, p. 397.

<sup>5</sup> Plomley: Australasian Med. Gaz., September 20, 1906, p. 455.

<sup>6</sup> Welt-Kakels, S.: New York Med. Jour., 1904, vol. lxxx, p. 689.

<sup>7</sup> Pollack: Amer. Jour. Dermat. and Gen.-urin. Dis., July, 1909, p. 289.

<sup>8</sup> Holt: Diseases of Infancy and Childhood, 1908, p. 689, fourth ed.

<sup>9</sup> Kimball: Med. Rec., 1903, vol. lxiv, p. 761, No. 20.

<sup>10</sup> Pott: Jahrb. f. Kinderheilk., 1883, vol. xix.

<sup>11</sup> Holt: New York Med. Jour. and Phila. Med. Jour., March 18, 1905.

in the Babies' Hospital between 1899 and 1904. Skutsch<sup>1</sup> described an epidemic in which 236 school-girls were sufferers. The infection was contracted in a crowded public bath-house. The patients varied from six to fourteen years of age. All manifested evidences of infection in periods varying from one to two weeks. A number of boys used the same bath-house, but none were diseased. Cotton,<sup>2</sup> Kimball,<sup>3</sup> Baer,<sup>4</sup> and many others report epidemics of greater or less severity.

**Modes of Infection.**—Gonorrhea may be propagated by accidental infection, by the infectionist, by the sadist, by precocious sexual intercourse, and in rare instances by the passage of the child through an infected maternal birth-canal. Vulvovaginitis neonatorum is extremely infrequent, although Aichel<sup>5</sup> states that this method of infection is probably more common than is generally supposed. Cases of gonorrheal vulvovaginitis neonatorum have been reported by Epstein<sup>6</sup> (3 cases, 2 of which were associated with gonorrheal ophthalmia), Aichel,<sup>7</sup> Woods,<sup>8</sup> Strzeminski, Koblanck,<sup>9</sup> and Dowd.<sup>10</sup> Breech presentations would seem to favor this method of infection. This was the case in Woods' patient. Gonorrheal vulvovaginitis neonatorum would doubtless be more frequent if it were not for the fact that at the first bath given the infant the genitalia are usually cleansed, and that, in cephalic presentation, the parts are more or less protected during the passage of the child through the birth-canal. There is reason to believe that intragenital infection may occur in rare instances.

The manner of infection naturally varies with the age of the child. In children less than eight or ten years of age the large majority of cases are the result of accidental contamination, usually by means of infected thermometers, underclothing, bed-linen, napkins, towels, sponges, wash-cloths, syringes, bath-tubs, or even by bath-water, the first two especially being frequent sources of infection in hospital wards. Excluding those cases of gonorrhea that are contracted during

<sup>1</sup> Skutsch: Inaug. Diss., Jena, 1891.

<sup>2</sup> Cotton: Arch. f. Pediat., New York, 1905, vol. xxii, p. 100.

<sup>3</sup> Kimball: Med. Rec., 1903, vol. lxiv, p. 761, No. 20.

<sup>4</sup> Baer: Jour. Infect. Dis., 1904, vol. i, p. 313.

<sup>5</sup> Aichel, O.: Hager's Beiträge, 1900, vol. ii, No. 2.

<sup>6</sup> Epstein: Arch. f. Dermat. u. Syph., 1891, vol. xxiii, p. 3; also *Traité des Maladies de l'enfant*, 1893, vol. iii.

<sup>7</sup> Aichel, O.: Hager's Beiträge, 1900, vol. ii, No. 2.

<sup>8</sup> Woods, R. F.: Amer. Jour. Med. Sci., 1903, p. 311.

<sup>9</sup> Koblanck: Cent. f. Gyn., July 13, 1895, p. 758.

<sup>10</sup> Dowd: Ann. of Surg., February, 1902.



the child's stay in an institution, Pott<sup>1</sup> has shown that 90 per cent. of the mothers of these patients had a more or less pronounced leukorrhea, and infection from such sources doubtless constitutes a large proportion of the original contaminations. Morgenstern and others have reported such cases. Children may also contract gonorrhea from infected toilet-seats, from sitting about on doorsteps or on rugs that have previously been soiled by a filthy and perhaps drunken parent. At least one case is on record in which a girl received an infection at her first menstruation from using a vulvar pad previously infected by an older sister. Atmospheric infection does not occur. In older children other modes of infection are relatively more frequent. Pollack<sup>2</sup> has studied 187 cases of acquired venereal infection occurring among children treated in the Johns Hopkins Hospital Dispensary, and finds that the greatest number (24) were infected at six years. Between six and twelve years of age the number dropped to about 9, but after this gradually rose, and at the fifteenth year the number of infected cases was found to be 20. Of Pott's<sup>3</sup> 86 cases, 56 were under five years of age.

One of the most frequent causes of outrages committed on children is the superstition that if a person affected with an acute gonorrhea can transmit the disease to a virgin, he or she, as the case may be, will be immediately cured. Incredible as this may seem, the belief is wide-spread, especially among ignorant foreigners, and particularly those coming from southern Europe. As early as 1853 Wilde,<sup>4</sup> of Dublin, reports the histories of cases infected as a result of this superstition. That this method of infection is not infrequent is shown by the fact that Seippel<sup>5</sup> has, during the last six months, examined 53 girls, most of whom were attacked as a result of this superstition. Of these, 13 were under eleven years of age. Krafft-Ebing<sup>6</sup> also refers to numerous such cases. The infectionist is usually a man, although Wolbarst<sup>7</sup> records a case in which a number of little boys were thus contaminated by a prostitute. According to Pollack,<sup>8</sup> many of the children infected as a result of this superstition present no evidence of rape, the infectionist apparently not desiring coitus.

<sup>1</sup> Pott: *Jahrb. f. Kinderheilk.*, 1883, vol. xix.

<sup>2</sup> Pollack: *Amer. Jour. Dermat. and Gen.-urin. Dis.*, July, 1909, p. 289.

<sup>3</sup> Pott: *Jahrb. f. Kinderheilkunde*, 1883, vol. xix.

<sup>4</sup> Wilde: *Med. Times and Gazette*, Dublin, September 10, 1853.

<sup>5</sup> Seippel, C. P.: *Illus. Med. Jour.*, July, 1912, p. 50.

<sup>6</sup> Krafft-Ebing: *Psychopathia Sexualis*, English ed., 1906, p. 561.

<sup>7</sup> Wolbarst: *Jour. Amer. Med. Assoc.*, September 28, 1901, p. 829.

<sup>8</sup> Pollack: *Amer. Jour. Dermat. and Gen.-urin. Dis.*, July, 1909, p. 289.

In examining children it should be remembered that the young child's hymen does not form *carunculæ myrtiformes* when ruptured, but simply shows serrations on its free border, and on account of the delicacy of the membrane, often bleeds but little. In young girls in whom coitus frequently occurs the hymen entirely disappears. Pollack<sup>1</sup> believes that between 800 to 1000 children are infected annually in Baltimore. The sadist and individuals affected with other forms of sexual perversion are also accountable for a definite proportion of assaults upon little girls. Precocious sexual intercourse among children is probably comparatively infrequent, and, as a result, gonorrhea is rarely contracted in this way. As the girls grow older and reach the age of thirteen or fourteen, or perhaps even a year or two earlier, the proportion that acquire gonorrhea during coitus becomes much greater. After the establishment of menstruation gonorrhea in girls differs in no essential from the same disease as it occurs in adults.

**Symptoms.**—Among young girls and infants the most frequent parts of the genital tract attacked by the gonococcus are the vagina and vulva. The infection seldom extends to the body of the uterus or adnexa in young children in whom menstruation has not yet been established, although involvement of the portio vaginalis probably occurs in the majority of cases. Indeed, Perrin<sup>2</sup> states that in a series of about 100 cases reported by him the vaginal cervix was involved in every instance. Even in latent cases, when the vulvovaginitis seemed about cured, gonococci were often found at the external os. Jung<sup>3</sup> states that the gonococci seldom penetrate above the external os.

The infrequency of vaginitis among adults and its great prevalence among infants and little girls are most striking, and can be explained by the fact that in the latter the lining of the vagina is thin, tender, and undeveloped, and is, therefore, receptive to the gonococcus. Cases differ markedly in severity: some are subacute from the onset, whereas in others the acute stage is productive of serious symptoms. In the mild cases only a slight itching or burning is present in the affected areas. Ardor urinæ is generally a pronounced symptom, and may occur even when the urethra is not involved. Retention of urine due to pain is not infrequent. Slightly painful micturition often persists, even after the subsidence of the acute symptoms. In severe acute cases—and this applies to all vulvovaginal infections in both adults and children—the pain is greatly increased by walking. In order to obtain relief the patient must go to bed and lie with the

<sup>1</sup> Pollack: *Loc. cit.*    <sup>2</sup> Perrin: *Rev. Méd. de la Suisse Romande*, November 20, 1911.

<sup>3</sup> Jung: *Zent. f. Gyn.*, 1904, vol. xxviii.

thighs widely separated. On examination a discharge, which may vary from a slight moisture to a copious, thick, purulent leukorrhea, will be observed. This discharge is yellow or yellowish-green, and in severe cases may be blood tinged or of a dirty, reddish-brown color. The discharge contains gonococci, which during the acute stage can be easily detected. In long-standing chronic cases the demonstration of these microorganisms is often difficult. In infants the amount of discharge is frequently small. In neglected cases excoriations are usually present about the external genitalia, on the perineum, the inner and upper part of the thighs, and occasionally in the genitocrural region. Crusts may form, which, on removal, leave a bleeding area behind. Annoying exanthemata and a foul odor may result. Condylomata may occur. Small erosions frequently surround the orifice of the vagina and the urethra, if the latter is involved. The labia, and especially the labia majora, are swollen, tender, and are frequently found partially glued together. The hymen and the lining membrane of the vagina are reddened and edematous, and may bleed when touched. Examination during the acute stage causes pain, but when the disease has become chronic, this is by no means always the case. Urethritis is the most frequent complication, but is found only in the minority of cases. In Pollack's<sup>1</sup> series of 187 cases urethritis was present in 18 per cent. of the patients, while Scheuer<sup>2</sup> reports this complication as occurring 15 times in a series of 39 cases.

In some cases a caruncle develops and leads to painful symptoms. When the urethra is involved, the usual symptoms of an inflammation of this area are present. During the acute stage slight fever, the temperature sometimes reaching 100° to 101° F., with its accompanying symptoms, may be present, but when the case becomes chronic or during mild attacks, these symptoms are absent.

Acute inflammatory symptoms usually disappear in from three to six weeks, after which time the discharge becomes scanty, milky or serous in character, and the pain disappears or is greatly alleviated. At this stage the symptoms are often extremely mild and are frequently overlooked. Severe constitutional symptoms are usually indicative of the onset of complications. Peritonitis and cardiac, renal, or other complications may occur. Ophthalmia is not uncommon. Septicemia or other manifestations of a general infection, such as arthritis or endocarditis, may result. Kimball<sup>3</sup> states that among 70

<sup>1</sup> Pollack: *Amer. Jour. Dermat., etc.*, July, 1909.

<sup>2</sup> Scheuer: *Wien. klin. Woch.*, 1909, No. 18.

<sup>3</sup> Kimball: *Med. Rec.*, November 14, 1903, p. 761.

cases of vulvovaginitis occurring in the Babies' Hospital, 10 cases of arthritis developed. Unless gonorrheal vaginitis receives proper treatment, adhesions or atresia may occur. Indeed, Findley<sup>1</sup> states that certain so-called congenital anomalies, such as imperforate hymen, adhesions, and malformation of the uterus and adnexa, may be ascribed to gonorrhea acquired *in utero*. Hamilton<sup>2</sup> states that among 344 cases of gonorrheal vulvovaginitis occurring in children, the average age of whom was five years, 3 cases of arthritis developed.

**Diagnosis.**—This is based on the presence of the symptoms just described and the finding of gonococci in the vaginal discharge. In this connection it should be remembered that in those cases in which the discharge is scant or in which the disease is chronic, the demonstration of the specific microorganism is often difficult. For this reason all vaginal discharges occurring in children should be viewed with suspicion, and the cases treated, so far as prophylactic methods and isolation are concerned, as if they were of gonorrheal origin, until at least three bacteriologic examinations, performed under circumstances favorable for the detection of the gonococcus, have proved negative. It is only by adopting the strictest prophylactic measures that the spread of the disease can be checked. This is especially the case in institutions. Chapple<sup>3</sup> and others have reported cases of pneumococcal and other forms of vulvovaginitis in children which were clinically indistinguishable from gonorrheal lesions.

**Prophylactic Treatment.**—Prophylaxis consists of making frequent bacteriologic examinations of all vaginal discharges occurring in little girls and in the strictest isolation of infected cases. In institutions this can hardly be too rigidly carried out. The importance of making an early diagnosis and insuring complete isolation cannot be too strongly emphasized. The nurses attending the children should also be isolated, and all contaminated dressings should be burned. Special thermometers, douche-pans, and other instruments used in the treatment of these cases must be employed. It is only by maintaining strictest quarantine that the spread of the disease to other children can be prevented. Indeed, the numerous epidemics that occurred in different well-conducted institutions years ago have led to the assertion that this variety of gonorrhea was spread by air infection. This is now known to be incorrect, but the ease and rapidity with which gonorrheal vulvovaginitis may be propagated

<sup>1</sup> Findley, P.: Western Med. Rev., April, 1912, vol. xvii, No. 4, p. 186.

<sup>2</sup> Hamilton: Jour. Amer. Med. Assoc., April 9, 1910.

<sup>3</sup> Chapple, H.: Lancet, June 22, 1912.

through a ward are most surprising. A further difficulty in checking the spread of gonorrheal vulvovaginitis lies in the fact that not a few of the subacute and chronic cases present practically no subjective symptoms. For this reason some institutions make a practice of routinely examining a smear from the vaginal secretion of each child upon admittance, and of isolating the case until the bacteriologic report has been made.

The importance of making a routine examination in institutions is shown by the statistics of Seippel,<sup>1</sup> who states that of 252 cases of gonorrheal vulvovaginitis admitted to a hospital, 136, or 54 per cent., were brought for some condition other than the vulvitis.

Prophylactic measures for nurses and physicians brought in contact with these cases should be thoroughly carried out. Numerous cases are on record in which ophthalmia has been contracted as a result of carelessness in this respect. All adults suffering from gonorrhea should be notified of the infectious nature of the disease; women suffering from genital gonorrhea should not allow their young children to sleep in the same bed with them. Trenwith<sup>2</sup> states that in the large majority of his cases vulvovaginitis could be indirectly traced to gonorrhea in the father.

Recognizing the frequency of gonorrhea in childhood, and realizing the impossibility of treating these cases successfully without special organization for the purpose, the Mount Sinai Hospital Dispensary (New York) has inaugurated a special class for the treatment of these cases, and has appointed a special physician to look after the department, who is assisted by a graduate nurse. The cases enrolled since the organization of this class are so numerous that the dispensary has been compelled to restrict its treatment to children residing in the immediate neighborhood. The New York Medical Journal<sup>3</sup> suggests the organization of similar classes in other parts of the city.

**Curative Treatment.**—This should be based on the same general principles as previously indicated as suitable for the same condition in the adult, with the exception that in the child antiseptic washes and irrigating fluids must necessarily be somewhat weaker in strength on account of the delicacy of the lining membrane of the vagina in the young. Wagner<sup>4</sup> recommends copious douches—20 to 25 liters—of sterile water at 45° C. once daily for the treatment of this condition. He has been employing this treatment for the last

<sup>1</sup> Seippel, C. P.: Ill. Med. Jour., July, 1912, p. 50.

<sup>2</sup> Trenwith: New York Med. Jour., February 3, 1906, p. 240.

<sup>3</sup> August 17, 1912, p. 339.

<sup>4</sup> Wagner: Berlin. klin. Woch., December 25, 1911, No. 52.

year in his service at Frankfort a. M., with excellent results. Menge<sup>1</sup> employs camomile tea to cleanse the external genitalia, and 1 or 2 per cent. silver nitrate for the vagina. Doleris<sup>2</sup> advises irrigations of potassium permanganate and the application of an ointment composed of benzoin, camphor, and cubebs, 5 grains of each to 25 grains of petrolatum, by means of tampons. If the hymen is intact and the disease is persistent, or if the membrane is of such character as seriously to interfere with the necessary treatments, it will in many cases be wise to sacrifice this structure, so that more thorough treatment may be instituted. Absolute cleanliness is essential. Even in the most carefully treated cases the disease is eradicated only with extreme difficulty and relapses are of frequent occurrence.

In some cases it is possible to treat the vagina and cervix through a cystoscope. The instrument can usually be introduced through the hymen without injuring this structure. Perrin<sup>3</sup> employs an endoscope, and applies a solution of protargol, glycerin, and distilled water, and follows this by the introduction of a small tampon of absorbent cotton, moistened in a similar solution, between the labia. In 100 cases treated by this method Perrin states that cures were obtained in periods varying from two weeks to twenty days. Kimball<sup>4</sup> states that gonorrheal vulvovaginitis is more amenable to treatment in children under one year of age than in older ones. In Cotton's<sup>5</sup> cases the average duration of the disease was between three and four months, whereas Skutsch<sup>6</sup> states that after twelve weeks of treatment the vaginal discharge from 140 cases was examined, and gonococci were demonstrated in 43 per cent. of the patients. Epstein<sup>7</sup> asserts that he has often seen cases lasting from infancy until the child has attained an age of nine or ten years, and Bruschke<sup>8</sup> reports cases persisting for four years in spite of active treatment. Hamilton<sup>9</sup> records that of 61 cases of gonorrheal vaginitis discharged as cured, 14 returned with recurrences of the condition in periods varying from six months to two years. His requisite for cure was four consecutive negative bacteriologic examinations (smears) conducted at weekly intervals. If the case can be properly treated, a duration of four or five months

<sup>1</sup> Menge, K.: *Handb. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>2</sup> Doleris, P.: *Paris Méd.*, May 4, 1912.

<sup>3</sup> Perrin: *Rev. Méd. de la Suisse Romande*, November 20, 1911.

<sup>4</sup> Kimball: *Med. Rec.*, vol. lxiv, No. 20.

<sup>5</sup> Cotton: *Arch. f. Pediat.*, 1905, vol. xxii, p. 100.

<sup>6</sup> Skutsch: *Inaugural Diss.*, Jena, 1891.

<sup>7</sup> Epstein: *Traité des maladies de l'enfance*, 1893, vol. iii.

<sup>8</sup> Bruschke: *Therapie der Gegenwart*, 1902.

<sup>9</sup> Hamilton: *Jour. Amer. Med. Assoc.*, April 9, 1910.



must be viewed as exceptional. A cure should be expected in a much shorter time, provided the treatment is properly applied. The long duration in many cases is due to the difficulty in persuading the parents to bring their children for routine treatment after the discharge lessens.

Trenwith<sup>1</sup> found that the average duration of the disease, in a series of 12 cases that he was able to follow carefully, was four and one-quarter months.

It is interesting, however, to note here that Sanger<sup>2</sup> and Marx<sup>3</sup> call attention to the fact that some cases of pelvic inflammatory disease in young virgins may be produced by the persistence of a gonorrheal vulvovaginitis contracted during infancy. Currier<sup>4</sup> believes that many undeveloped uteri which cause dysmenorrhea and sterility are the result of gonorrheal vulvovaginitis of childhood. Especial care must be taken entirely to eradicate the infection. A case should be pronounced cured only after at least three negative bacteriologic examinations and disappearance of all local symptoms.

Dispensary cases, because of the difficulty of obtaining routine and thorough treatment, are productive of particularly unsatisfactory results. Complications require special treatment.

**Complications.**—These are frequent, especially in neglected or untreated cases.

**Inguinal adenitis** often occurs, but rarely progresses to the suppurative stage. In Pollack's series of 187 cases buboes were present in 28, or 15 per cent. Only 2 advanced to the stage of pus-formation.

**Cystitis.**—If the urethra is involved, cystitis may develop, but bladder complications are, as a rule, seldom encountered. Thus Bruschke<sup>5</sup> reports 1 case of cystitis occurring among 50 cases of vaginitis.

**Bartholinitis** is not infrequent, and differs in no essential from a similar condition in the adult.

**Condylomata Acuminata.**—Venereal warts are frequently seen in neglected cases, and in some instances attain considerable size.

**Arthritis** is moderately frequent, even in young infants. It is generally accompanied by symptoms of systemic infection, and

<sup>1</sup> Trenwith, W. D.: New York Med. Jour., February 3, 1906, p. 240.

<sup>2</sup> Sanger: Quoted by Welt-Kakels, S.: New York Med. Jour. and Phila. Med. Jour., October 8, 1904.

<sup>3</sup> Marx: Gaz. d. Gyn., November 15, 1895.

<sup>4</sup> Currier: Quoted by Welt-Kakels, S.: New York Med. Jour. and Phila. Med. Jour., October 8, 1904.

<sup>5</sup> Bruschke: Quoted by Welt-Kakels, S.: New York Med. Jour. and Phila. Med. Jour., October 22, 1904.



most frequently affects the wrist, elbow, ankle, knee, fingers, toes, or other small joints. It is usually multiple at the onset and later localizes to one or occasionally more joints. It may be acute, subacute, or rarely suppurative in character. In infants the subacute variety is most prevalent. Koplik<sup>1</sup> reports 2 cases occurring in a series of 100 cases of vulvovaginitis. In Welt-Kakels<sup>2</sup> series of 190 cases arthritis developed in 3 patients, whereas in Pollack's group there were 3 cases. In 1897 Epstein<sup>3</sup> collected 28 of these cases from the literature and added 2 of his own. He remarks upon the frequency of this condition, and believes that the gonorrheal origin is often overlooked.

**Tenonitis.**—Seiffert<sup>4</sup> has reported a case of tenonitis in a child suffering from gonorrheal vulvovaginitis. Gonococci were demonstrated in the fluid removed by puncture.

**Ophthalmia**, often the result of hand infection, is not uncommon, particularly in neglected cases.

**Proctitis** may occur, and differs in no respect from a similar condition in the adult. It is present in from 1 to 5 per cent. of all cases.

Kaumheimer<sup>5</sup> believes proctitis to be more frequent than is generally supposed; he emphasizes the fact that in cases of vulvovaginitis the temperature should not be taken per rectum, owing to the dangers of infection. He states that in many cases of proctitis the symptoms are extremely mild.

**Peritonitis** is not an infrequent complication of gonorrheal vulvovaginitis, although Holt<sup>6</sup> states that in one series of 273 cases of gonorrheal vulvovaginitis no extension to the tubes, peritoneum, or bladder was observed. As compared with similar conditions in the adult, gonorrhea of the uterus and adnexa is extremely infrequent. This may be accounted for by the fact that prior to the establishment of menstruation the cervical canal is tightly contracted and more or less occluded by a plug of thick, tenacious cervical mucus. The comparative rarity of extension upward of gonorrheal vulvovaginitis in children is a further proof, if such were needed, of the statement previously made that the spread of this disease to the endometrium of the uterus in the adult almost invariably occurs either at a menstrual period, immediately follows the emptying of a pregnant uterus, or as a result of intra-uterine manipulations. In the child, these conditions being absent, extension

<sup>1</sup> Koplik: Jour. Cutan. and Gen.-urin. Dis., 1892, vol. x.

<sup>2</sup> Welt-Kakels, S.: New York Med. Jour. and Phila. Med. Jour., October 22, 1904.

<sup>3</sup> Epstein: Traité des maladies de l'enfance, 1897, vol. iii.

<sup>4</sup> Seiffert: Jahr. f. Kinderheilkunde, 1896.

<sup>5</sup> Kaumheimer: Münch. med. Woch., May 3, 1910.

<sup>6</sup> Holt: New York Med. Jour. and Phila. Med. Jour., March 18, 1905.

upward rarely takes place. On the other hand, gonorrheal peritonitis the result of a septicemia is much more often observed in children than among adults. Gonorrheal peritonitis may be acute or subacute from the onset. The mode of infection of the peritoneum is somewhat doubtful. A certain proportion of cases are complicated by tubal lesions, and in these the route of infection can easily be demonstrated. It is believed that general peritonitis occurs so frequently in these cases because the peritoneum of children is more receptive to infection than is that of the adult, and a salpingitis, that in a woman would lead only to a pelvic peritonitis, and that would quickly become localized, will, in a young child, often result in a general involvement of the entire peritoneum. Pyemia is also more frequent in infancy and childhood. Systemic infection must be taken into consideration in studying these cases, as not a few operations and autopsies have been performed on children in which macroscopically the uterus and adnexa have been found normal, the infection in these cases undoubtedly having occurred along routes similar to those involved in arthritis or in endocarditis.

**Symptoms.**—The onset of peritonitis is generally abrupt. The temperature rises rapidly to 101° to 103° F. or higher. The pulse and respiration are rapid. The abdomen is distended and tender. The bowels are usually constipated, but in rare cases diarrhea may be present. The pain is severe and often paroxysmal in type. The child is fretful and refuses nourishment. The extremities are cold, the face is cyanosed, and the facies abdominalis may be observed. Vomiting and tympanites may be pronounced symptoms. If the condition is chronic, loss of weight, anemia, sleeplessness, and other evidences of severe illness become manifest. In those cases in which there is adnexal involvement the greatest tenderness and pain occur over these regions.

Dysuria, painful defecation, and general malaise are usually present, together with leukocytosis and other evidences of peritonitis.

Arthritis is not infrequent. In 35 cases of subacute or chronic peritonitis studied by Galvagno<sup>1</sup> there was a mortality of 20 per cent. Carpenter<sup>2</sup> states that even in cases where massive pathology is present, spontaneous recovery may result. In young children the pelvic localization of gonorrheal peritonitis, even when of tubal origin, is markedly less than in the adult, and, as a result, general peritonitis is relatively more frequent.

**Diagnosis.**—The diagnosis is dependent on the symptoms just de-

<sup>1</sup> Galvagno: *Arch. di Patolog. e Clin. Infant.*, 1904, vol. ii, Nos. 3, 4, p. 73.

<sup>2</sup> Carpenter, G.: *Brit. Jour. Child. Diseases*, October, 1904, p. 437.

scribed, combined with the presence of a vulvovaginitis in the discharge from which gonococci can be demonstrated. It is important that appendicitis, intussusception, volvulus, and other acute abdominal lesions be excluded. This can usually be done with certainty by a careful study of the case. Hatfield<sup>1</sup> Baginsky,<sup>2</sup> Mejia,<sup>3</sup> Hunner and Harris<sup>4</sup> (3 cases), Dowd,<sup>5</sup> Welt-Kakels,<sup>6</sup> Galvagno<sup>7</sup> (3 cases), Sebilleau<sup>8</sup> (3 cases), Northrup<sup>9</sup> (2 cases), Bidwell,<sup>10</sup> Carpenter,<sup>11</sup> Comby<sup>12</sup> (8 cases), Marx,<sup>13</sup> Koplik<sup>14</sup> (16 cases), and others report cases of pelvic or general peritonitis of gonorrheal origin.

**Treatment.**—The treatment of gonorrheal peritonitis in children is similar to that of adults. Especial effort should be made to avoid operating during the acute stage, not only because abdominal sections among infants and young children are accompanied by a comparatively high mortality, but also because these patients seem peculiarly amenable to the palliative treatment, and complete cures by this method are often effected.

The various other complications that occur as a result of gonorrheal vulvovaginitis in children are pyemia, endocarditis or pericarditis, proctitis, stomatitis, rhinitis, and ophthalmia. These will be described in the chapter on the Complications of Gonorrhea.

#### GONORRHEA IN THE AGED

Active gonorrhea in women past fifty years of age is infrequent. At this period the sexual life of the individual is on the wane, menstruation has ceased, and in many cases the menopause has been established. In this connection, however, it should be remembered that women vary widely. In some the sexual life and even menstruation are continued much longer than in others. The occurrence of pregnancy after forty-five is infrequent,<sup>15</sup> and when the menopause

<sup>1</sup> Hatfield, M. P.: *Arch. of Ped.*, 1886.

<sup>2</sup> Baginsky: *Lehrb. der Kinderkrankheiten*, 1902.

<sup>3</sup> Mejia: *Abst. Central. f. allgem. Path. u. pathol. Anat.*, 1901, vol. xii.

<sup>4</sup> Hunner and Harris: *Bull. Johns Hopkins Hosp.*, 1902.

<sup>5</sup> Dowd: *Ann. Surg.*, February, 1902.

<sup>6</sup> Welt-Kakels, S.: *New York Med. Jour. and Phila. Med. Jour.*, October 29, 1904.

<sup>7</sup> Galvagno, P.: *Arch. di Patol. e Clin. Infant.*, 1904.

<sup>8</sup> Sebilleau: *Gazette des Hôpitaux*, March 8, 1904, p. 261.

<sup>9</sup> Northrup, W.: *Arch. of Ped.*, 1903, No. 12, p. 940.

<sup>10</sup> Bidwell, L. A.: *Brit. Jour. Children's Dis.*, 1904, vol. i, p. 435.

<sup>11</sup> Carpenter, G.: *Brit. Jour. Children's Dis.*, 1904, vol. i, p. 437.

<sup>12</sup> Comby, J.: *Arch. de med. des enfants*, September, 1901, p. 515.

<sup>13</sup> Marx: *Med. Rec.*, January, 1896.

<sup>14</sup> Koplik: *Dis. of Infancy and Childhood*, 3d ed.

<sup>15</sup> Norris, Charles C.: *Jour. Amer. Med. Assoc.*, April 22, 1911; also *Amer. Jour. Obst.*, 1910, vol. lxi, No. 2.

has been established, the likelihood of gonorrhea spreading above the cervix is extremely improbable, unless intra-uterine manipulations are performed. As has frequently been stated, the time at which gonorrhea is most prone to extend above the cervix is either at a menstrual period or following the emptying of a pregnant uterus. As menstruation and pregnancy are absent in the aged, extension of gonorrheal cervicitis is unlikely.

As a further cause for infrequency of active gonorrhea at this period the physiologic changes that are occurring throughout the genital tract must be considered. All the structures usually attacked by the gonococcus are beginning to undergo atrophy, and the blood-supply of the various organs is diminished. In addition, the likelihood of contracting a primary gonorrhea at this time is much lessened. Promiscuous sexual intercourse is certainly uncommon at this age, and the probability of a husband becoming infected and thus contaminating his wife is likewise lessened.

The lesions produced by the gonococcus have been described in previous chapters. Many women of forty years suffer from gonorrhea, and are not operated upon or even treated during the succeeding ten years. What, then, becomes of the gonococcus in these cases? It would seem that, as a result of the physiologic changes already indicated, the microörganism first becomes innocuous and later perishes. This conclusion has been reached by a study of the clinical material alone. Of the last 125 cases of pelvic inflammatory disease operated upon in the Gynecologic Department of the University of Pennsylvania, the oldest patient was forty-seven years of age, and the average age was 29.9 years. The following table shows the age in five-year periods at which the various patients were operated upon:

	NUMBER OF CASES	PER CENT.
15 to 20 years .....	2	1.6
20 " 25 " .....	38	30.4
25 " 30 " .....	31	24.8
30 " 35 " .....	16	12.8
35 " 40 " .....	19	15.2
40 " 45 " .....	13	10.4
45 " 47 " .....	6	4.8

Active gonorrhea of the lower genital tract in the aged is extremely uncommon—far more so than is a corresponding condition in the male. This may largely be accounted for by the longer sexual life in the latter. The fact that even intraperitoneal gonorrhea is rarely troublesome after the establishment of the menopause should be taken into consideration in treating cases of pelvic inflammatory disease that are approaching this period of life. This should not, however, be

allowed to overrule the clinical judgment of the gynecologist in treating these patients. It must be remembered that although relatively few cases of pelvic inflammatory disease are operated upon after the menopause, practically all severe cases are acquired much earlier in life, and are, therefore, operated upon early or receive curative treatment, so that comparatively few severe lesions are found at this period of life.

## CHAPTER XVII

### COMPLICATIONS AND NON-GENITAL GONORRHEA.—CYSTITIS.— ADENITIS.—PROCTITIS.—STOMATITIS.—RHINITIS.—OPH- THALMIA IN INFANTS, YOUNG GIRLS, AND ADULTS

#### GONORRHEAL CYSTITIS

THIS is a comparatively frequent complication of gonorrhea of the lower genital tract, and is usually a consequence of an extension backward of an inflammation of the urethra. Catheterization or other instrumentation in cases of gonorrheal urethritis may result in carrying the infection to the bladder, and in this way also a cystitis may be produced. In rare cases, perhaps, cystitis may result from a systemic or renal infection, but this is doubtful. In many instances the gonococcus is present in combination with other microorganisms, such as the streptococcus, staphylococcus, *Bacillus coli*, or other pyogenic cocci.

The earlier writers believed that gonorrheal cystitis was always the result of a mixed infection, but the works of Wertheim<sup>1</sup> and Young<sup>2</sup> have amply proved the fallacy of this supposition. Melchoir<sup>3</sup> was probably the first to recover the gonococcus from the urine in a case of acute cystitis under conditions that would fairly exclude the possibility of urethral contamination. Unfortunately, his results were not confirmed by culture, and to Wertheim<sup>4</sup> belongs the credit of having absolutely demonstrated these organisms from an acute case. His report was followed shortly by that of Lindholm,<sup>5</sup> with similar results. Young<sup>6</sup> was the first to demonstrate gonococci in pure culture in a chronic case. In some of Young's cases the urine was obtained by suprapubic aspiration, thus positively excluding the possibility of urethral contamination. In Wertheim's case, however, a piece of bladder-wall was excised through a cystoscope, and gonococci found within the tissue, whereas in the other cases mentioned cystitis was demonstrated by the cystoscope. Gonococci from the bladder are difficult to cultivate, owing to the fact that

<sup>1</sup> Wertheim: *Zeit. f. Geb. u. Gyn.*, vol. xxxv, No. 1, p. 1.

<sup>2</sup> Young, H. H.: *Contributions to the Science of Medicine*, Baltimore, 1900, p. 677.

<sup>3</sup> Melchoir, M.: *Cystite et Infection Urinaire*, Paris, 1895.

<sup>4</sup> Wertheim: *Zeit. f. Geb. u. Gyn.*, vol. xxxv, No. 1, p. 1.

<sup>5</sup> Lindholm: *Lyon Méd.*, November 15, 1896.

<sup>6</sup> Young, H. H.: *Contributions to the Science of Medicine*, Baltimore, 1900, p. 677.

unless the urine contains considerable albumin the gonococci do not thrive. It may partially be due to this fact that gonococcal cystitis is not more frequent, especially in women. Young<sup>1</sup> has also shown that in rare instances gonococci may be present in the bladder without producing an inflammation.

In long-standing, chronic cases the possibility of a tuberculosis being superimposed upon the original Neisserian infection should be considered. Kümmell<sup>2</sup> has reported a number of such cases. Tuberculosis of the bladder unassociated with renal tuberculosis is, however, uncommon. Predisposing causes are not necessary to the production of gonorrheal cystitis. Factors that lower the resistance of the vesical mucosa, however, favor the extension of infection to this organ, and act unfavorably during the course of the disease. The chief causes predisposing to cystitis are, therefore, interference with the blood-supply of the bladder, such as is sometimes produced by pressure from a neoplasm, the fetal head, or a vaginal pessary, chronic congestion, as in uterine displacements, pregnancy, excessive coitus, cold, anemia, overdistention of the bladder, vesical calculi, irritating drugs, cystocele, debility, wasting diseases, trauma, and vesical tumors. Pericystitic inflammatory disease, such as gonorrheal lesions of the tubes, ovaries, or body of the uterus, may be contributing factors in the production of cystitis, not only by causing congestion, but as the result of a direct infection through the bladder-wall. In gonorrheal cystitis, however, the latter is of rare occurrence, the cystitis usually being the result of an original urethritis.

The trigone is the area first infected. The inflammation may remain localized in this region, or may spread to the entire vesical mucosa. Trigonitis is much more frequent than cystitis, and this is the locality in which the disease is most resistant to treatment. Knorr<sup>3</sup> states that extension from the urethra to the bladder is most likely to occur during the acute stage of the infection, but that a trigonitis or cystitis may result from a latent urethritis. Owing to the shortness of the urethra, women are more frequently the incumbents of gonorrheal cystitis than men. Barlow<sup>4</sup> has reported cases of this condition occurring in infants and young children.

**Symptoms.**—The disease may begin as an acute attack, or may be subacute from the onset. During the acute stage the symptoms are generally marked. Urination is frequent, imperative, and pain-

<sup>1</sup> Young, H. H.: Johns Hopkins Hospital Reports, vol. ix, p. 677.

<sup>2</sup> Kümmell, H.: Surg., Gyn., and Obst., April, 1911.

<sup>3</sup> Knorr, R.: Zeitschr. f. gynäk. Urol., Leipzig, February, 1910, vol. ii, p. 54.

<sup>4</sup> Barlow: Arch. f. Dermat., 1893.



ful; ardor urinæ and tenesmus are often prominent symptoms. The pain is usually relieved after emptying the bladder, but in some cases may continue. There is, as a rule, a feeling of fullness and weight in the pelvis, and if the patient attempts to retain her urine, sharp, cutting pains in the region of the anus and rectum may occur. Rectal tenesmus may also be present. Constitutional symptoms are not, as a rule, severe. Slight fever, malaise, headache, and loss of appetite may be present for a few days at the onset or during the height of the attack. The systemic symptoms usually disappear in a short time without treatment. The urine is generally acid and cloudy, and contains blood, vesical epithelium, pus, mucus, or uric acid. It may be alkaline. Tenderness is present over the bladder and urethra, and inspection of the latter reveals the characteristic appearance seen in infections of this region. Evidences of gonorrhea can usually be detected in the cervix and often in Bartholin's glands. The urine contains gonococci, which may be demonstrated by the method previously described. (See page 59.) Care must, however, be observed that urethral contaminations do not occur, and even the most painstaking technic is imperfect unless a cystoscopic examination is performed, and the diagnosis is confirmed by inspection as well as by the result of examination of specimens obtained direct from the diseased area. In some cases confrontation is possible, but this is of little value except so far as it reveals the variety of the original infection.

When the disease becomes chronic, the same general symptoms are present, but in a less aggravated form. With the aid of the cystoscope the diagnosis of cystitis or trigonitis is not difficult at this stage, but the determination of the microorganism productive of the condition is frequently not so easy. It seems hardly necessary to state that the cystoscope should not be employed indiscriminately during the acute stage of either a gonorrheal cystitis or in the presence of an acute urethritis. Careful modern bacteriologic methods will, however, clear up any doubt that may exist as to the etiology of the condition. The acid urine, the presence of gonorrhea in Skene's glands and in the lower genital tract, together with the history that usually accompanies such cases, are factors pointing toward the gonorrheal origin of the inflammation. Cystoscopic examination shows the vesical mucosa to be reddened, thickened, and inflamed. The congestion is generally most marked at the trigonum. In some cases ulcers may be present; these may bleed spontaneously or on the slightest touch, or they may be sluggish in type. Areas of granulation tissue may be observed, partially or entirely covered by pus or a deposit of cellular

débris and urinary salts. Ulcers on the vertex are less apt to cause severe symptoms than when situated on the base, and may produce discomfort only when the bladder is full; on the other hand, when situated on the floor of the bladder, the raw area is constantly brought into contact with the urine, and also, on account of the more abundant nerve-supply of this portion of the bladder, these ulcers are productive of greater pain. Ulcers at the trigonum are often characterized by tenesmus, and urination is frequently accompanied by the passage of varying amounts of blood.

**Treatment.**—During the acute stage the patient should be kept in bed and the bowels regulated. The diet should be restricted, and should consist, as nearly as possible, of milk; diluent drinks are indicated, and all alcohol should be interdicted. Salol and urotropin in 5- to 7-grain doses should be given every six hours. A good plan is to administer the salol and follow it in three hours by the urotropin, a large glass of water being taken with each dose. A half-pint of water is thus given every three hours. In this connection it is important to bear in mind that Burnam's test has shown that in 50 per cent. of patients taking urotropin formaldehyd does not appear in the urine. This result has been confirmed by L'Esperance and Cabot.<sup>1</sup> This fact is apparently not influenced by the amount of urotropin administered. The urine should, therefore, be examined for formaldehyd in all cases. Hexamethylenamin usually gives excellent results, provided the urine is acid. Jordan<sup>2</sup> has shown that the liberation of formaldehyd occurs to only a limited extent if the reaction is alkaline, and not at all in the presence of free ammonia. Hot hip-baths are often comforting to the patient, and if the pain is severe, morphin may be required. The external genitalia should be kept clean by frequent irrigations of sterile water, bichlorid 1:12,000, or other weak antiseptic solutions. An irrigation of the external genitalia should follow each urination, the best method being to have a large irrigating apparatus constantly beside the patient's bed. A sterile dressing should be placed over the vulva.

During the chronic stage of cystitis local treatment should be instituted. This consists of irrigating the bladder once or twice daily with sterile water or normal salt solution, or, best of all, a weak silver nitrate solution, 1:5000 to 1:500. In applying the irrigation, the bladder should be distended sufficiently to allow the solution to reach all parts of the mucosa. The irrigation should be followed by the in-

<sup>1</sup> L'Esperance, O. R. T., and Cabot, H.: Boston Med. and Surg. Jour., October 24, 1912.

<sup>2</sup> Jordan, A.: Biochem. Jour., 1911, vol. v, p. 271.

stillation of some mild antiseptic, one of the most satisfactory of which is a 95 per cent. solution of silver iodid suspended in mucilage of acacia or Irish moss. Ulcers on the vesical mucosa are best treated by direct applications made through the cystoscope, silver nitrate, in 5 to 20 per cent. solution, being the most satisfactory application, the strength of the solution being reduced as the ulcers heal. Dilatation of the urethra to 20 mm. is often beneficial in obstinate cases, while continuous drainage with a mushroom-tipped soft catheter may, in some cases, be employed with advantage. When the latter mode of treatment is adopted, the catheter should be changed every two or three days, and every effort made to keep it clean while in place. In very persistent cases the formation of a vesicovaginal fistula, for the purpose of allowing the bladder to rest and producing constant drainage, may be necessary.

#### LYMPHADENITIS

Lymphadenitis of the inguinal glands, although a frequent complication of gonorrhea in the male, is comparatively infrequent in the female. In women the inflammation rarely progresses to the suppurative stage. A low-grade adenitis is occasionally encountered as a complication of gonorrhea of the lower genital tract, or pelvic inflammatory disease, which manifests itself by slight pain or tenderness in the inguinal regions at and for a few days preceding menstruation. At these periods the glands on one or, more rarely, on both sides are somewhat enlarged and sensitive. The subjective symptoms disappear in a few days. In some instances the glands may be enlarged and somewhat tender between the menstrual periods, but this is uncommon. This condition, as a rule, requires no treatment. During pregnancy, the puerperium, and as a complication of vulvovaginitis in childhood adenitis is more frequent, but even at such times it is seldom encountered. The treatment during the early stages consists in the application of cold and free incision and drainage if pus is formed.

Adenitis in other areas is a rare condition. In 1896 Petit and Pichevin<sup>1</sup> recorded the history of a case in which gonococci were recovered in pure culture from an adenitis of the glands of the neck. This is the first case from which gonococci have been demonstrated in pure culture from lymphatic glands other than the inguinal region.

<sup>1</sup> Petit and Pichevin: *Jour. d. Mal. Cutan. et Syph.*, Paris, 1896, p. 419.

## PROCTITIS

Jesionek<sup>1</sup> was the first to cultivate the gonococcus from the mucosa of the rectum, and thus absolutely establish the identity of this condition.

Gonorrheal proctitis is more frequent in women than in men, because of the closer anatomic relationship that exists in the former between the genito-urinary organs and the rectum, and that allows gonococci-bearing discharges from the vagina to escape over the perineum and anus. Proctitis is seldom encountered, even among women. In this country the disease is most frequently met with among low-class foreigners, and is often due to the practice of sodomy. Baer<sup>2</sup> states that infection of the rectum occurs in 30 per cent. of all female gonorrheics, while Huber<sup>3</sup> places the proportion at 25 per cent. Both these figures are, the author believes, much too high. Jullien<sup>4</sup> collected the statistics of Schultz, Baer, and Howard, which comprised 1037 cases of genital gonorrhea in women; in this series 157 showed rectal involvement.

Proctitis is more often met with in young children as the result of vulvovaginitis than in adults. The condition may be either a primary infection of the rectum or secondary to gonorrhea of other organs. Primary gonorrheal proctitis may result from coitus per anus or from contamination of the rectum by a septic rectal examination, instrumentation, or operation, an infected syringe nozzle, or an enema tube. In infants the condition may result from contamination of the rectum during the passage of the child through the birth-canal. Secondary proctitis is the variety most frequently observed. That this condition is not more prevalent can be explained by the fact that the sphincter is usually tightly contracted, and that the structures external to it are covered by squamous epithelium, a type of tissue in which the gonococcus never flourishes. Lockyer<sup>5</sup> asserts that direct contact of the gonorrheal discharge with the deeper parts of the anal canal is necessary for infection. The frequency with which the perineum and anus are soiled with gonococci-bearing leukorrheal discharges, and the comparative infrequency of involvement of the rectum, are proofs in themselves of the correctness of the foregoing statement. Gonorrheal proctitis may in rare instances be caused by a direct infection from an adherent uterine appendage. The author has seen

<sup>1</sup> Jesionek, A.: *Deut. Arch. f. klin. Med.*, Leipzig, 1898, vol. lxi, p. 91.

<sup>2</sup> Baer: *Deut. med. Wochenschr.*, 1896, vol. xxii, p. 116.

<sup>3</sup> Huber: *Arch. f. Dermat. u. Syph.*, 1897, vol. xi, p. 237.

<sup>4</sup> Jullien: *Bull. de l'Acad. de Méd.*, Paris, 1907, vol. lxxi, p. 497.

<sup>5</sup> Lockyer: Quoted by Zobel, A. J.: *The Proctologist*, 1909, vol. iii, p. 188.

three cases resulting from the rupture of a pyosalpinx into the rectum. Proctitis resulting from a tubo-intestinal fistula is likely to be extremely chronic, owing to constant reinfection. In all cases of proctitis in women a thorough pelvic examination should be made, as in most cases the disease is secondary to gonorrhea of the genital tract. Systemic infection is not impossible.

**Symptoms.**—These vary widely in different cases and during the various stages of the disease. At the onset there are usually heat, itching, and a feeling of fulness about the anus and lower rectum, which rapidly progress, and pain soon becomes a prominent symptom. It is excruciating during defecation, and as a result the patient often permits herself to become constipated. Tenesmus is almost invariably a marked feature. This symptom can often be elicited by having the patient strain or tightly contract the sphincter. Palpation of the affected areas causes severe pain. The soreness about the rectum is augmented by walking, and is relieved by rest in the recumbent posture. The lowermost portion of the intestine is almost invariably primarily involved, and, as a consequence, during the early stages of the infection it is in this locality that the symptoms are most marked. The patients usually complain of a feeling of heat, weight, and discomfort about the pelvis. Irritability of the bladder may be present. Moderate pyrexia and its accompanying phenomena are usually associated with proctitis. As the disease becomes more chronic the severity of the symptoms is somewhat lessened; the patient may be weak, look haggard, and feel feverish. In some cases the symptoms are extremely mild. During the acute stage the discharge consists of yellowish pus, but later it may become thin. It is frequently blood-stained. According to McVeigh,<sup>1</sup> in severe or neglected cases bleeding may be a pronounced symptom.

Examination generally reveals an exanthematous condition of the peri-anal region, and the eruption may extend to the thigh, perineum, and buttocks. The cutaneous surface is covered with a moist, more or less purulent, secretion. Condylomatous growths are often present, and are similar to those observed in gonorrhea of the genital tract. Fissures are often present. The most frequent location for a fissure is in the posterior anal border. It is often partially covered by a venereal wart, and can sometimes be demonstrated only by pushing the latter aside. Strictures may result.

Small furuncles may be seen about the anus and in the anal and gluteal folds. If the infection is the result of sodomistic practices, the anus is often depressed—the so-called funnel-shaped anus. During

<sup>1</sup> McVeigh: *The Proctologist*, September, 1912, p. 172.

the acute stage instrumental or digital examination is often impossible without the aid of an anesthetic, on account of the sensitiveness of the rectum. In neglected or long-standing cases fissures may develop about the anus, producing marked redness and infiltration of the mucosa. Ulcers are not uncommon. In some individuals the sphincter is relaxed, and on straining the mucosa of the rectum may be brought into view. As the result of edema a partial prolapse may take place, somewhat similar to the chemosis encountered in acute inflammation of the conjunctiva. A cicatrix may be present in the rectum or sphincter, and perirectal abscesses may result.

Jadassohn<sup>1</sup> believes the latter to be a not infrequent complication of proctitis. Complications, such as arthritis or endocarditis, may occur. As a general rule the disease is confined to the lower 3 or 4 inches of the rectum, but in severe cases more extensive involvement is not uncommon. In chronic cases a curiously depressing effect, resembling neurasthenia, similar to that sometimes produced by a posterior urethritis in the male, is occasionally observed. In infants, during the early stage, the condition may somewhat simulate the more frequent intestinal disorders resulting from improper feeding.

The **diagnosis** of gonorrheal proctitis depends upon the demonstration of the specific microorganism in the discharge. In this connection it is important to remember that when a positive diagnosis is desirable, the *Micrococcus catarrhalis* and other microorganisms that are morphologically similar to the gonococcus, and which may be found in the alimentary tract, must be excluded. The presence of gonorrhea in the genito-urinary tract, the history of the case, the presence of a funnel-shaped anus, and the absence of other etiologic factors are points that should put the physician on his guard for this type of infection. Wiener<sup>2</sup> has reported a case with secondary parenchymatous nephritis.

**Treatment.**—Not infrequently, during the acute stage, on account of the exquisite sensitiveness of the affected area, the employment of intrarectal applications are impossible. Cleanliness is at all times of paramount importance. The peri-anal region should be frequently washed with warm water and Castile soap, then dried, and a dusting-powder, such as zinc stearate or boric acid, applied. In some cases where the dermatitis is severe applications of sweet oil are beneficial.

A pad of absorbent cotton should be worn between the buttocks, and over all a sterile gauze dressing should be placed. As in treating vulvitis, every effort should be made to keep the affected areas dry

<sup>1</sup> Jadassohn: Deut. Klinik, Berlin, 1905, vol. x, pp. 601-660.

<sup>2</sup> Wiener, E.: Med. Klin., Berlin, 1912, vol. viii, p. 1029.



and clean. A laxative, preferably a saline aperient, should be administered. Hot sitz-baths are often beneficial in relieving the tenesmus and other acute symptoms. As soon as it is found feasible, a rectal douche of sterile water should be administered three or four times daily. For this purpose Zobel<sup>1</sup> recommends one dram of sodium bicarbonate to the pint of warm water. This may be given through a two-way catheter. This solution tends to remove the secretion that is adherent to the rectal mucosa. As a further treatment a daily application of one of the milder silver salts is indicated. For this purpose the patient should be placed in the knee-chest or elevated Trendelenburg posture, and the peri-anal region wiped clean with cotton moistened in some antiseptic solution. A small, well-lubricated proctoscope or a small Sims' speculum should then be inserted into the rectum. If the latter instrument is employed, it is a good plan to use the gloved finger as an obturator. After an inspection of the rectum has been made and the lower bowel cleansed as well as possible, a small tampon should be inserted and the rectum irrigated. A solution of argyrol (10 to 20 per cent.) or silver nitrate (0.25 to 1 per cent.) is then poured in through the speculum. The tampon benefits not only by smoothing out the folds of the rectal mucosa and thus facilitating the treatment, but it becomes saturated with the solution, and in this way enables the operator to apply the germicide over a protracted period. If small, the tampon may be left in place and will be passed without difficulty at the first bowel movement. Ulcerations of the rectum, fistula, or other complications should also be treated at this time. If gonorrhea is present in the genital tract, it should receive appropriate treatment. This is especially necessary in women, in whom proctitis is usually secondary to gonorrhea of the genital tract.

The patient had best be kept in bed during the acute stage, and, if the general condition permits, receive a restricted diet. Albumin-water, on account of the small amount of ash produced, is an excellent diet during the acute stage. Proctitis is frequently extremely chronic and resistant to treatment. Jullien<sup>2</sup> mentions treating 3 cases of his series for periods of one hundred and sixteen, one hundred and sixty-nine, and one hundred and seventy-four days respectively.

#### GONORRHEAL STOMATITIS

This is a rare variety of infection, and may occur in infants or in adults, and is probably more frequent in the latter. The mouth

<sup>1</sup> Zobel, A. J.: *The Proctologist*, 1909, vol. iii, p. 188.

<sup>2</sup> Jullien: *Bull. de l'Acad. de Méd., Paris*, 1907, vol. lxxi, p. 497.



being lined by squamous epithelium, is a poor soil for the development of the gonococcus under ordinary conditions. The absence of a horny layer is, however, a factor that favors infection. In infants the layer of squamous epithelium is thin, and, as a result, infection easily occurs. Koplik<sup>1</sup> states that the infection is favored by trauma of the mucosa. It is likely that gonorrheal stomatitis in infants is more common than is generally suspected, and the gonococcal factor is probably not infrequently overlooked. In infants the condition is usually produced by contamination of the buccal cavity with gonorrheal discharges during the passage of the child's head through the birth-canal. It is not infrequently associated with a specific ophthalmia. Rosinski<sup>2</sup> states that the condition is much more frequent in infants than in adults. He reports 5 cases. Krast<sup>3</sup> and Dohrn<sup>4</sup> also report cases. Leyden<sup>5</sup> records a case of gonorrheal ophthalmia neonatorum complicated by a pustule in the mouth from the discharge of which gonococci were obtained. Mixed infection is probably frequent. Jürgens<sup>6</sup> reports a case in which the bacillus of Vincent's angina was present. The glands of the neck on the right side were swollen and tender. Gonococci were demonstrated by staining, but not by culture methods, and for this reason the diagnosis is open to doubt.

The disease generally becomes manifest in two or three days, and, according to Rosinski,<sup>7</sup> is not accompanied by constitutional symptoms. Koplik<sup>8</sup> states that the severity of the constitutional symptoms varies markedly in different cases: in some instances they are practically absent, but in other cases may be marked and accompanied by the usual evidences of septicemia. He has seen cases that ended fatally, but this result is probably due to a general infection, rather than to the stomatitis. As a general rule, this form of infection is milder in the young than in adults. The children often continue to nurse, and alimentation is not interfered with. The mucosa of the mouth presents yellowish elevations, which are especially numerous over the palatine arches. The roof of the mouth and the anterior portion of the tongue are the parts chiefly affected, whereas the lips and cheeks may be free. If the yellowish papules are removed, they will be found to possess a whitish or pinkish base that tends to bleed.

<sup>1</sup> Koplik, H.: *Diseases of Infancy and Childhood*, New York and Philadelphia, third ed.

<sup>2</sup> Rosinski: *Zeitschr. f. Geb. u. Gyn.*, Stuttgart, 1891, vol. xxii, p. 216, 1 pl.; p. 359, 1 pl.

<sup>3</sup> Krast: *Inaug. Diss.*, Bonn, 1894.

<sup>4</sup> Dohrn: *Cent. f. Gyn.*, 1891, No. 22.

<sup>5</sup> Leyden: *Cent. f. Gyn. u. Geb.*, February 24, 1894.

<sup>6</sup> Jürgens: *Berlin. klin. Woch.*, June 13, 1904, No. 24.

<sup>7</sup> Rosinski: *Loc. cit.*

<sup>8</sup> Koplik, H.: *Diseases of Infancy and Childhood*, New York and Philadelphia, third ed.

In a few days a purulent discharge appears, which is gradually dissolved by the saliva. Pus is especially noticeable in the region occupied by the yellowish ulcers. The pus contains gonococci. The saliva may be clear. The deposits are never membranous, as in diphtheria. Recovery usually takes place in a few weeks.

In the adult gonorrheal stomatitis is a more serious condition. The malady is generally the result of an infection contracted during buccal coitus, or it may be a complication of a well-defined general infection. The disease may also result from contamination of the mouth by infected fingers or instruments. Karo<sup>1</sup> states that gonococci may be present in the mouth without causing infection. The disease is characterized by a sensation of heat, burning, and pain in the affected area. Expectoration is copious, and consists of purulent saliva, which is often blood tinged and of a foul odor. Eating causes intense pain and sometimes bleeding. The ingestion of liquids also produces discomfort. The patient complains of a bad taste, and nausea is generally present. The tongue is swollen and tender, and can be protruded only a short distance. The breath is foul, and the teeth may become loose. On examination, the mucosa, particularly that of the soft palate, vulva, posterior portion of the tongue, and the cheeks, is found reddened, inflamed and granular in appearance. The gums are frequently retracted and spongy. Numerous ulcers, which vary in size, may be present. These bleed readily when touched. The ulcers are covered by a whitish or yellowish, sticky, non-adherent membrane. Jesionek<sup>2</sup> has recorded the history of a case complicated by a bilateral gonorrheal conjunctivitis. Numerous grayish-white patches were present on the mouth and tongue. Soreness was marked, and the sublingual gland was inflamed. The gonococci were identified by their morphologic and staining properties. Vines<sup>3</sup> has reported the history of a case of gonorrheal gingivitis. The patient was the incumbent of a specific arthritis; a tooth-pick is believed to have been the infecting agent. Swelling of the jaws was marked, excessive salivation was present, and all the teeth were loose. The temperature was 101° F., and the breath was foul. Recovery occurred in about six weeks. The method of identification of the gonococci is not stated.

In severe cases of stomatitis the lips are cracked and herpes may form. The false membrane and the pus contain gonococci. Moderate fever accompanies the acute stage of the disease.

Crosby<sup>4</sup> has reported a fatal case of septicemia in which gonococci

<sup>1</sup> Karo, W.: *Internat. Jour. Surg.*, June 29, 1909, p. 162.

<sup>2</sup> Jesionek, A.: *Deut. Arch. f. klin. Med.*, Leipzig, vol. lxi, p. 91.

<sup>3</sup> Vines, S.: *Brit. Med. Jour.*, 1903, p. 425.

<sup>4</sup> Crosby, D.: *Amer. Jour. Med. Sci.*, 1905, New York, vol. exxix, p. 880.

were recovered from the nose, mouth, lungs, trachea, and pleura. In this case the stomatitis was a marked feature. The patient was a man, thirty-one years of age; the symptoms of the general infection appeared three weeks after the acquisition of gonorrheal urethritis. The mouth and lips were swollen and congested, the breath was foul, and marked salivation was present. At autopsy the teeth were found to be loose, and much pus was present about their roots. The period of incubation in cases of primary stomatitis is not definitely known. Cutler<sup>1</sup> has recorded a case in which the symptoms appeared in twenty-four hours after buccal coitus, and were well developed by the fifth day. Holder<sup>2</sup> has seen a case in which they appeared on the fourth day. Kimball<sup>3</sup> has recorded a case of gonorrheal septicemia in an infant in which the point of entry seems to have been by way of a stomatitis.

The **diagnosis** depends upon the demonstration of a specific micro-organism in the secretion or lesions. On account of the not infrequent presence in the mouth of organisms morphologically and tinctorially similar to the gonococcus, cultures are necessary to establish a positive diagnosis.

**Treatment.**—In infants the frequent washing of the mouth with sterile water or sterile water and glycerin is usually sufficient. In adults a more vigorous course of treatment is necessary. The mouth should be cleansed with a solution of glycerin and bismuth subnitrate solution and the ulcers touched with silver nitrate. This treatment should be applied once or twice daily. A mouth-wash containing potassium chlorid, alum, or boric acid should be employed. Prophylactic measures to prevent the spread of the infection to the eyes or to other individuals should be enforced. Cases of gonorrheal stomatitis have been reported by Leedham-Green,<sup>4</sup> Rosinski,<sup>5</sup> Cutler,<sup>6</sup> Hymen,<sup>7</sup> De Forest,<sup>8</sup> Malherbe,<sup>9</sup> and others.

#### NASAL GONORRHEA

The existence of nasal gonorrhea in the adult is still doubted by many authorities. Few recent instances of this condition have been

<sup>1</sup> Cutler: Quoted by Taylor: *Genito-urinary and Venereal Diseases*, 1904.

<sup>2</sup> Holder: Quoted by Taylor: *Genito-urinary and Venereal Diseases*, 1904.

<sup>3</sup> Kimball, R. B.: *Med. Rec.*, November 14, 1903, p. 461.

<sup>4</sup> Leedham-Green: *Treatment of Gonorrhea*, London, 1908.

<sup>5</sup> Rosinski: *Zeit. f. Geb. u. Gyn.*, 1891, vol. xxii.

<sup>6</sup> Cutler: Quoted by Taylor: *Genito-Urinary and Venereal Diseases*, 1904.

<sup>7</sup> Hymen, S. M.: *New York Med. Jour.*, January 29, 1907.

<sup>8</sup> De Forest, H. P.: *Amer. Jour. Obst.*, 1910, vol. lxi, p. 153.

<sup>9</sup> Malherbe, H.: *Gaz. méd. de Nantes*, 1911, vol. xxix, p. 801.

reported, and in the majority of cases a thorough bacteriologic examination is lacking. Diday and Bormiere<sup>1</sup> endeavored to inoculate the nasal mucous membrane of adults, but without success. Extension of the disease from an existing stomatitis has been asserted as a cause by some writers, and indeed, this seems quite possible. De Stella<sup>2</sup> appears to have definitely established the existence of gonorrheal rhinitis in the infant, and it is not impossible that if nasal discharges in the new-born were systematically examined with this end in view, gonococci might sometimes be found. Owing to the occasional presence of the *Micrococcus catarrhalis*, only cultural methods can be accepted as positive. In Crosby's<sup>3</sup> case of gonorrheal septicemia gonococci were recovered from the inflamed nasal mucosa, and although no cultures were made, the general clinical characteristics of the case leave little doubt as to the correctness of the diagnosis. The fact, however, that a gonorrheal stomatitis and pneumonia were present, and that the patient was frequently coughing up gonococci-laden sputum, may perhaps account for the infection, or the latter may have spread by direct continuity from the mucosa of the mouth. In his report Crosby does not consider the route of the infection to the nose.

#### GONORRHEAL OPHTHALMIA NEONATORUM

Prior to the introduction, in 1881, of the Credé prophylactic treatment, ophthalmia neonatorum was an extremely frequent disease. Leopold<sup>4</sup> states that thirty-eight or forty years ago every maternity hospital had a room or a suite set apart for the treatment of sufferers from this malady. Interesting historic reviews of this disease may be found in the works of Hirschberg<sup>5</sup> and Hausmann.<sup>6</sup> Even today gonorrheal ophthalmia neonatorum is by no means infrequent. Stephenson<sup>7</sup> has collected data from 53 provincial poor-law lying-in departments, aggregating 17,579 births. Among this number, 128, or 0.72 per cent., showed purulent ophthalmia. The same authority states that of 4884 births in the London hospitals during 1894-95, 176, or 3.6003 per cent., were attacked by this malady. Among 35,815 births occurring in six British maternities, ophthalmia resulted in 79, or 0.22 per cent., of cases.

<sup>1</sup> Diday and Bormiere: Quoted by Jullien: *Bull. de l'Acad. de Méd., Paris*, 1907.

<sup>2</sup> De Stella: *Deut. med. Zeit.*, 1899, No. 1.

<sup>3</sup> Crosby, D.: *Amer. Jour. Med. Sci.*, 1905, New York, vol. cxxix, p. 880.

<sup>4</sup> Leopold: *Berlin. klin. Woch.*, 1902, No. 33.

<sup>5</sup> Hirschberg: *Centralbl. f. prak. Augenheilk.*, 1894.

<sup>6</sup> Hausmann: *Die Bindehautinfektion der Neugeborenen*, 1882.

<sup>7</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 10.

Mayou<sup>1</sup> states that ophthalmia neonatorum cost the community £350,000 per year for educating and looking after blind children, and urges legislative measures to insure prophylactic treatment. Kerr<sup>2</sup> records that, in the United States, the State of Massachusetts appropriated \$40,000 in 1910 for the support of blind asylums; the State of New York, \$110,000; whereas the biennial appropriation of the State of Pennsylvania for its blind asylums in 1909 amounted to \$265,000. When we aggregate private expenses, amounts spent by States and cities, and also the estimate of the potential earning power of individuals thus disabled, the economic loss on account of ophthalmia neonatorum will be found to be enormous. Cohen<sup>3</sup> states that the actual costs to the United States are \$1,800,000 yearly for the care of victims of ophthalmia neonatorum alone.

The proportion of cases of ophthalmia neonatorum among infants of the poor who have been born in their own homes is large, as many of the mothers are attended by ignorant midwives and are frequently the incumbents of neglected and uncured gonorrhea. The frequency of ophthalmia neonatorum naturally bears a direct ratio to the prevalence of gonorrhea in any given locality. As a result, it is less common in country than in urban populations. The most frequent cause of ophthalmia neonatorum is the gonococcus, this organism being responsible for about two-thirds of the cases. Stephenson<sup>4</sup> relates that in the practice of 41 observers, gonococci were found in 67.14 per cent. of 1658 cases of ophthalmia neonatorum. deSchweinitz<sup>5</sup> states that from 60 to 70 per cent. of cases are due to the gonococcus.

Other microorganisms that may produce ophthalmia neonatorum are the pneumococcus, *Bacillus coli*, Koch-Weeks bacillus, Klebs-Löffler bacillus, Morax-Axenfeld diplobacillus, pneumobacillus, influenza and pseudo-influenza bacillus, streptococcus and other common pyococci, streptobacillus, *Micrococcus luteus*, and *Bacillus pyocyaneus*. The gonococcus is productive of the most severe cases of ophthalmia neonatorum. Mayou<sup>6</sup> has collected the following statistics which show the frequency with which the gonococcus is the infecting agent in ophthalmia neonatorum:

<sup>1</sup> Mayou, S. M.: *The Practitioner*, London, 1908, vol. lxxx, p. 125.

<sup>2</sup> Kerr, J. W.: *Ophthalmia Neonatorum*, Public Health Bull., October, 1911, No. 49.

<sup>3</sup> Cohen, H.: *Ill. Med. Jour.*, April, 1912, p. 416.

<sup>4</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 35.

<sup>5</sup> deSchweinitz, G. E.: *New York State Jour. Med.*, June, 1912, p. 279.

<sup>6</sup> Mayou: *The Practitioner*, London, 1908, vol. lxxx, p. 200.

AUTHOR	NUMBER OF CASES	PERCENTAGE OF GONORRHEAL CASES
Kroner.....	92.....	68.47
Haab.....	16.....	87.50
Widmark.....	25.....	76.00
v. Ammon.....	100.....	56.00
Guerola.....	25.....	100.00
Neisser.....	92.....	68.47
Andrews.....	122.....	100.00
Hirschberg.....	32.....	100.00
Kopfstein.....	51.....	58.82
Francisco.....	40.....	75.00
Chartres.....	100.....	44.00
Gonin.....	38.....	58.00
Thomin.....	20.....	70.00
Reyling.....	14.....	71.42
Cohn.....	553.....	52.98
Groenouw.....	40.....	35.00
Alt.....	17.....	52.94
Stephenson.....	71.....	58.67
Mayou.....	35.....	57.50
Totals.....	1483.....	63.50

Gonorrheal ophthalmia in infants may result from an intra-uterine infection, from contamination of the child's eyes during the passage of the fetal head through the birth-canal, and from postpartum infection. These forms are important because of the difference in the time at which the disease becomes manifest. Considerable discussion has arisen as to the etiology of the intragenital development of ophthalmia neonatorum, and various theories have been advanced. As early as 1840 Crompton<sup>1</sup> reported the history of a case in which ophthalmia was advanced at birth. Rivaud-Landrau,<sup>2</sup> Wordsworth,<sup>3</sup> and Hausmann<sup>4</sup> are among the early observers of this condition. Golesecano<sup>5</sup> states that this variety of ophthalmia was present in 9.67 per cent. of a series of 186 cases. Of 25 cases, Würdemann<sup>6</sup> found that symptoms of ophthalmia were present in 20 per cent. of the infants at birth. Collins<sup>7</sup> observed this condition once in 32 cases. Collingsworth,<sup>8</sup> Veit,<sup>9</sup> and Jardine<sup>10</sup> refer to cases in which ophthalmia has been present in infants delivered by abdominal cesarean section. Barnes,<sup>11</sup> Taylor,<sup>12</sup> and Nieden<sup>13</sup> have observed cases of antepartum

<sup>1</sup> Crompton, S.: London Medical Gazette, new series, 1840-41, vol. i, p. 432.

<sup>2</sup> Rivaud-Landrau: Annales d'oculistique, 1857, vol. i, p. 66.

<sup>3</sup> Wordsworth, J. C.: Brit. Med. Jour., May 2, 1863.

<sup>4</sup> Hausmann: Die Bindehautinfektion der Neugeborenen, 1882.

<sup>5</sup> Golesecano: Bull. et mém. de la Soc. française d'ophtalmologie, 1904, p. 347.

<sup>6</sup> Würdemann: Amer. Jour. Ophthalmology, May, 1893, p. 151.

<sup>7</sup> Collins: The Practitioner, 1902, p. 428.

<sup>8</sup> Collingsworth: Trans. London Obst. Soc., July, 1903, vol. xlv, p. 356.

<sup>9</sup> Veit: Quoted by Barnes, F.: Brit. Med. Jour., November 5, 1881, p. 740.

<sup>10</sup> Jardine, R.: Trans. Edin. Obst. Soc., 1904, vol. xxix, p. 151.

<sup>11</sup> Barnes, F.: Brit. Med. Jour., November 5, 1881.

<sup>12</sup> Taylor, H. S.: Brit. Med. Jour., March 18, 1871.

<sup>13</sup> Nieden: Klin. Monats. f. Augenheilk., October, 1891, p. 353.

ophthalmia in infants born with a caul. In Taylor's case the child was delivered with the bag of waters unruptured. As a result of antepartum infection, either advanced or newly acquired ophthalmia may be observed at birth, or the malady may develop shortly after delivery. Early rupture of the membranes doubtless accounts for a certain proportion of these cases. Systemic infection may also explain a limited number. Stephenson favors the theory of local intra-uterine infection in the majority of cases, basing his opinion upon his clinical experience and upon the experimental work of Hellendall,<sup>1</sup> who has shown that bacteria may penetrate the intact membranes. Little more than one-third of the cases of intra-uterine infection can be accounted for by premature rupture of the membranes. In the remaining cases slight trauma or injury to the membranes, or even actual penetration of the latter by the microorganism, seems to be the most probable explanation of this variety of infection. According to Dorland,<sup>2</sup> "congenital ophthalmia" is more common than is generally supposed, he having found about 100 cases on record.

By far the greatest number of eyes are infected during or immediately following labor, the symptoms usually appearing before the fifth day. If it were not for the fact that at birth the eyes are usually tightly closed and more or less sealed by the fatty Meibomian secretion, infection would doubtless be much more frequent. Infections occurring some time after birth or, as they are termed, secondary infections, are frequent, constituting probably about one-fourth of all the cases. Owing to the variability of the period of incubation of the gonococcus, it is impossible, in many instances, positively to determine at what time and in what manner the contamination took place. Wintersteiner<sup>3</sup> refers to 122 cases of ophthalmia in which 32.78 per cent. were attacked after the fifth day. Among a series of 739 cases reviewed by Stephenson,<sup>4</sup> 48.65 to 80.64 per cent. developed symptoms within four days. Secondary infection may be conveyed by the hand or by contamination of various articles brought in contact with the eyes, such as sponges, water, towels, etc. Knies<sup>5</sup> mentions an epidemic caused by a midwife, who was herself the incumbent of an uncured genital gonorrhea.

**Symptoms.**—These usually appear within the first five days, one

<sup>1</sup> Hellendall, H.: Beiträge z. Geb. u. Gyn., 1905-1906, vol. x, pp. 1 and 320.

<sup>2</sup> Dorland, W. A. N.: Jour. Amer. Med. Assoc., October 14, 1911, p. 1285.

<sup>3</sup> Wintersteiner: Wien. klin. Woch., September 15, 1904, p. 988.

<sup>4</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 116.

<sup>5</sup> Knies: Die gonorrhöischen Bindehauterkrankungen u. deren Behandlung, Halle, 1896, p. 9.



or both eyes being affected. According to Billard,<sup>1</sup> the earliest sign is a narrow, transverse, congested line that appears in the center of the upper lid. This is rapidly followed by more marked evidence of inflammation. The eyelids, especially the upper one, become hot, reddened, tender, and swollen. A yellowish or greenish secretion soon appears, and the swelling of the affected parts becomes more marked. On account of the edema it is sometimes impossible to separate the lids without the aid of a lid-elevator. In severe cases the upper lid may hang over the lower. Attempts at examination cause acute pain. The secretion is copious, and the conjunctiva is reddened, thickened, and congested. A pseudomembrane not uncommonly is present. The ocular conjunctiva is not, as a rule, severely affected, and, unlike gonorrheal conjunctivitis in the adult, may show but little chemosis, probably due to the fact that in new-born infants the eyes are always closed. Ulcerations, varying in size, may be found upon the tarsal conjunctiva. As the disease progresses the swelling tends to subside, leaving the lids wrinkled. At this stage they can readily be everted. In severe or untreated cases the cornea may become infiltrated, present an opaque appearance, and be the seat of one or more ulcers. The corneal tissue may regenerate or perforation may occur, with resulting pyramidal cataract, adherent leukoma, and corneal staphyloma; or severe intra-ocular inflammation may occur, resulting in panophthalmitis or atrophy of the globe. In eyes with central corneal opacities the result of previous ulceration, amblyopia, nystagmus, and squint may subsequently develop. Blindness is not infrequently the termination in neglected or untreated cases. Stephenson<sup>2</sup> states that tenderness and tumefaction of the preauricular gland, which is in direct communication with the conjunctiva, is a frequent complication of gonorrheal ophthalmia. Moderate fever and its accompanying phenomena are usually present. During the height of the attack infants often suffer from diarrhea and refuse the nipple. Wolfrum<sup>3</sup> has recently described cases of ophthalmia neonatorum that closely resembled trachoma.

Hoeck<sup>4</sup> and Berger<sup>5</sup> have referred to cases complicated by abscesses about the lids, and Suker<sup>6</sup> records a case in which infection of the anterior ethmoid cells occurred. Arthritis as a complication

<sup>1</sup> Billard: *Traité des Mal. des Enfants Nouveau-nés*, third ed., p. 274.

<sup>2</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 141.

<sup>3</sup> Wolfrum, M. C.: *Münch. med. Woch.*, July, 1911, No. 28, p. 1503.

<sup>4</sup> Hoeck: *Jahresber. der Ophth.*, 1894, p. 531.

<sup>5</sup> Berger: *Arch. d'ophthal.*, vol. i, No. 14.

<sup>6</sup> Suker, G. F.: *Annals Ophthal.*, April, 1905.

has been observed by Altland<sup>1</sup> and others. Paulsen,<sup>2</sup> Haushalter,<sup>3</sup> Deutschmann,<sup>4</sup> Stevens,<sup>5</sup> Chartres,<sup>6</sup> and Stephenson<sup>7</sup> have mentioned cases accompanied by septicemia. Widmark<sup>8</sup> relates the history of a fatal case of ulcerative endocarditis, while Politzer<sup>9</sup> mentions a case followed by meningitis. Mayou<sup>10</sup> states that among other complications may be found infection of the lacrimal gland and rhinitis.

According to Cr  d  ,<sup>11</sup> the predisposing causes of gonorrheal ophthalmia neonatorum are premature rupture of the membranes and a protracted second stage of labor. Mayou<sup>12</sup> believes that in the infant the marked susceptibility of the conjunctiva to infection is due to the deficiency of the epithelium and the underdevelopment of the lymphoid tissue. Gueirel,<sup>13</sup> Cramer,<sup>14</sup> Stephenson,<sup>15</sup> and Zweifel<sup>16</sup> state that desquamation of the oculopalpebral surface and certain other changes that are often present in premature children are predisposing factors to this condition. Doubtless the absence of lacrimal secretion, which normally occurs in the newborn, is also a contributing cause. Ophthalmia neonatorum is more frequent in cephalic than in other forms of presentation. Face presentations especially favor infection.

Ophthalmia, while not generally a fatal disease, frequently leaves the patient hopelessly blind or with impaired vision. Burdett<sup>17</sup> has estimated that of the 50,568 blind persons in the United States, as shown by the census of 1890, no less than 39 per cent. owed their condition to ophthalmia neonatorum.

A committee of the British Medical Association found that more than one-third of the pupils of the blind schools of Great Britain owed their affliction to this disease.<sup>18</sup> In the United States and Canada, in 1907, out of 224 admissions to 10 schools for the blind, 59, or 24.38

<sup>1</sup> Altland: *Klin. Monatsbl. f. Augenheilk.*, April, 1902.

<sup>2</sup> Paulsen: *M  nch. med. Woch.*, August 28, 1900.

<sup>3</sup> Haushalter: *La Semaine M  d.*, 1895, vol. i, No. 14, p. 380.

<sup>4</sup> Deutschmann: *V. Graefe's Arch. f. Ophthalmologie*, 1890, vol. xxxvi, No. 1, p. 109.

<sup>5</sup> Stevens, E. W.: *Ophthal. Rec.*, November, 1905.

<sup>6</sup> Chartres, E.: *Th  se de Bordeaux*, 1896, p. 27.

<sup>7</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 143.

<sup>8</sup> Widmark, J.: *Rev. g  n. d'ophthalmologie*, Paris, 1888, vol. vii, p. 145.

<sup>9</sup> Politzer: *Jahr. f. Kinderheilk.*, 1870, p. 335.

<sup>10</sup> Mayou, S.: *The Practitioner*, 1908, pp. 125, 200, 354.

<sup>11</sup> Cr  d  : *Arch. f. Gyn.*, 1883, vol. xxi, p. 179.

<sup>12</sup> Mayou, S.: *The Practitioner*, 1908, pp. 125, 200, 354.

<sup>13</sup> Gueirel: *Le  ons de Clinique Obstetricale*, Paris, 1902, p. 198.

<sup>14</sup> Cramer: *Arch. f. Gyn.*, 1899, vol. lix, No. 1.

<sup>15</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1902, p. 130.

<sup>16</sup> Zweifel: *Cent. f. Gyn.*, 1900, p. 1374.

<sup>17</sup> Burdett, S. M.: *Century*, 1892.

<sup>18</sup> *Brit. Med. Jour.*, May 8, 1909.

per cent., were sightless as a result of ophthalmia neonatorum.<sup>1</sup> Of 351 admissions to certain schools in the United States and Canada in 1910, 84, or 23.9 per cent., were blind from this cause. Greene has studied ophthalmia neonatorum in 10 manufacturing cities of Massachusetts, and has found that the minimum morbidity for this disease was 6.4 per 1000 births. This investigator also compiled statistics obtained from 173 physicians practising in 9 different cities. In this series the morbidity rate was 10.8 per 1000 births. Rockliffe<sup>2</sup> found that in the Hull Blind Institution, of 590 cases of blindness, 91 were the result of ophthalmia neonatorum.

From data collected by Stephenson<sup>3</sup> it is shown that of 5995 cases of ophthalmia neonatorum treated in 16 ophthalmologic hospitals, 22.85 per cent. lost their sight or suffered an impairment of vision.

**Diagnosis.**—The diagnosis of gonorrheal ophthalmia neonatorum depends upon the bacteriologic demonstration of the specific micro-organism. If any delay is caused by obtaining a microscopic examination of the secretion, or doubt exists as to the presence of gonococci, the case had better be treated as one of gonorrhea until a thorough laboratory investigation can be carried out. Various forms of systemic gonorrhea may result from ophthalmia neonatorum. In 1899 Lucas<sup>4</sup> was able to collect from the literature the reports of 23 cases of joint lesions due to this type of infection; 18 of these cases followed ophthalmia neonatorum, whereas in the remaining 5 the infection was acquired later in life. The following authors are quoted by Lucas<sup>5</sup> as having recorded authentic cases of this condition: Lucas,<sup>6</sup> Fenwick,<sup>7</sup> Zatvornitski,<sup>8</sup> Debierre,<sup>9</sup> Widmark,<sup>10</sup> Darier<sup>11</sup> (2 cases), Deutschmann<sup>12</sup> (2 cases), Lindermann,<sup>13</sup> Morax,<sup>14</sup> Escherich,<sup>15</sup> Hoeck<sup>16</sup> (2 cases),

<sup>1</sup> Jour. Amer. Med. Assoc., May 23, 1909, p. 1745.

<sup>2</sup> Rockliffe, W. C.: Brit. Med. Jour., March 9, 1912.

<sup>3</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 14.

<sup>4</sup> Lucas, R. C.: Med.-Chirurg. Trans., published by the Roy. Med. and Chir. Soc., London, 1899, vol. lxxxii; second series, vol. lxiv, p. 137.

<sup>5</sup> Lucas: *Loc. cit.*

<sup>6</sup> Lucas, R. C.: Brit. Med. Jour., July 11, 1885; also Brit. Med. Jour., October 10, 1885.

<sup>7</sup> Fenwick, R. G.: Brit. Med. Jour., October 31, 1885.

<sup>8</sup> Zatvornitski: Ophthal., 1885.

<sup>9</sup> Debierre, L.: Rev. gén. d'ophtal., 1885, p. 209.

<sup>10</sup> Widmark, J.: Jahrb. f. Kinderheilk., 1886, vol. xxix, p. 152.

<sup>11</sup> Darier: Arch. d'ophtal., 1889, p. 175.

<sup>12</sup> Deutschmann: Arch. f. Ophthal. 1890, p. 107.

<sup>13</sup> Lindermann: Beiträge z. Augenheilk., June, 1892, No. 5, p. 30.

<sup>14</sup> Morax: Progrès Médicale, October 22, 1892.

<sup>15</sup> Escherich: Jahrb. f. Kinderheilk., October, 1893.

<sup>16</sup> Hoeck: Wien klin. Woch., October 12, 1893, p. 736.

Sobotka,<sup>1</sup> Moncorvo,<sup>2</sup> Haushalter,<sup>3</sup> Griffon,<sup>4</sup> Tyrrell,<sup>5</sup> Ashby and Wright,<sup>6</sup> and Berenstein.<sup>7</sup>

**Treatment.**—*Prophylactic Treatment.* During and preceding labor the mother should receive the treatment previously outlined under Treatment of Gonorrheias During Labor. The efficiency of the Credé method is amply proved by the statistics of Leopold,<sup>8</sup> Haab,<sup>9</sup> the Rotunda Hospital Reports,<sup>10</sup> and by those from practically all large maternities. It has been asserted that the instillation into the eye of a 1 or 2 per cent. solution of silver nitrate may produce a conjunctival catarrh, conjunctival hemorrhage, or even corneal opacities. If the method is properly carried out, and the weaker of these solutions is employed, these complications, if they occur at all, constitute so extremely small a proportion that they may practically be ignored. In this connection Hellendall's<sup>11</sup> recent report is of interest. This observer has collected data from 28 clinics, with a total of over 50,000 cases. He concludes that when the so-called silver catarrh occurs, it is the result of impure preparations being employed, which liberate free sulphuric acid. According to Hellendall, a 1 per cent. silver nitrate solution never produces a reaction. The original Credé<sup>12</sup> method prescribed the use of a 2 per cent. solution of silver nitrate. This, however, was found to be too strong, clinical experience having demonstrated that equally good results may be obtained with a weaker solution. Runge,<sup>13</sup> Hofmeier,<sup>14</sup> von Hecker,<sup>15</sup> Dauber,<sup>16</sup> Leopold,<sup>17</sup> and many others recommend a 1 per cent. solution. Very satisfactory results have also been obtained by the employment of a 1:4000 corrosive sublimate solution, or one of the newer silver preparations, such as argyrol, protargol, or silver acetate (1 or 1.25 per cent.) instead of the silver nitrate. Zweifel<sup>18</sup> recommends a weak solution of silver acetate.

<sup>1</sup> Sobotka: *Prog. med. Woch.*, 1893, p. 582.

<sup>2</sup> Moncorvo: *La Méd. Infantile*, July 15, 1894.

<sup>3</sup> Haushalter: *Rev. Mens. des Mal. de l'enfance*, October, 1895.

<sup>4</sup> Griffon: *Presse Méd.*, 1896, No. 15.      <sup>5</sup> Tyrrell: *Med. News*, March 7, 1896, p. 271.

<sup>6</sup> Ashby and Wright: *Diseases of Children*, 1896.

<sup>7</sup> Berenstein: *Cent. f. prak. Augenheilk.*, March, 1897, p. 84.

<sup>8</sup> Leopold: *Münch. med. Woch.*, May 1, 1906.

<sup>9</sup> Haab: *Correspondenzbl. f. Schw. Ärzte*, 1886, vol. xv, p. 7.

<sup>10</sup> Rotunda Hospital, clinical reports of, 1905 and 1905.

<sup>11</sup> Hellendall: *Monats. f. Geb. u. Gyn.*, 1911, vol. xxxiii, No. 2, p. 42; also *Zentralbl. Gynäk.*, Leipzig, 1911, vol. xxxv, p. 1453.

<sup>12</sup> Credé: *Arch. f. Gyn.*, 1881, vol. xviii, p. 367.

<sup>13</sup> Runge, E.: *Berlin. klin. Woch.*, May 19, 1902, p. 20.

<sup>14</sup> Hofmeier: *Ref. Medical News*, September 23, 1905.

<sup>15</sup> von Hecker: *Arch. f. Gyn.*, vol. xx, No. 3, p. 378.

<sup>16</sup> Dauber: *Münch. med. Woch.*, February 16, 1904, p. 297.

<sup>17</sup> Leopold: *Münch. med. Woch.*, May 1, 1906.

<sup>18</sup> Zweifel: *Zentralbl. f. Gyn.*, July 6, 1912.

On account of the non-irritating properties of argyrol and protargol, these preparations may with advantage be substituted for silver nitrate in cases in which it is necessary to have the application made by an unskilled attendant. Either protargol or argyrol must be applied frequently if good results are to be obtained. Of the two, argyrol is the more efficient remedy, and, while less irritating, its germicidal action is not so marked. It should be freshly prepared with cold water and stored in a dark place. For routine work nothing has as yet proved equal, in the writer's opinion, to a silver nitrate solution of 1 or 1.25 per cent. strength. Its gonococcal properties are far superior to those of any of the other silver preparations. For statistics pertaining to the action of various drugs employed for prophylactic purposes see Chapter XX.

*Prophylactic Technic.*—As soon as the head is born the eyes should be wiped with absorbent cotton moistened with boric acid solution (10 grains to the ounce); following this, as quickly as may be convenient, a thorough irrigation of the eyes with a similar solution should be resorted to, after which 2 drops of a 1 per cent. solution of silver nitrate should be instilled into each eye. This need not be neutralized. Care should be observed to see that the solution is well distributed. The arms and hands should be dried as soon as possible, and the baby so placed that it cannot touch its eyes. In cases in which the mothers are known to be gonorrheics, the plan suggested by Abbott,<sup>1</sup> which consists in placing a small occlusive bandage over the eyes as soon as the face has been cleansed with a damp antiseptic cloth, may also be employed. Care must always be observed to avoid possible post-partum infection. For this reason the infant's face should be washed separately from the remainder of its body.

To prevent late infection, all women the incumbents of a gonorrhea should be warned of the infectious nature of the discharge, and children should be absolutely forbidden to sleep in the same bed with infected parents.

Any measures that will lessen the prevalence of gonorrhea will also diminish the frequency of gonorrheal ophthalmia. Such means have been discussed in a previous chapter. Notification of ophthalmia neonatorum seems to be especially effective in this variety of gonorrhea. In Paris, London, and certain parts of the United States notification is imperative. deSchweinitz<sup>2</sup> states that in Boston, where notification is compulsory, not a single known instance of the disease having resulted in blindness has occurred in any of the reported cases.

<sup>1</sup> Abbott, G. E.: Med. Rec., September 21, 1889, p. 317.

<sup>2</sup> deSchweinitz, G. E.: New York State Jour. Med., June, 1912, p. 279.

The Social Service Department of the University of Pennsylvania Hospital has, by prompt attendance in such cases, saved the sight of many children. Notification not only secures prompt and efficient treatment, but also insures the enforcement of proper measures to prevent the spread of the disease. In addition, valuable data can thus be obtained. All midwives should be taught how to apply proper prophylactic measures against this disease.

*Curative Treatment.* In the treatment of ophthalmia neonatorum, as in other forms of gonorrheal infection, the indications are to keep the affected area clean and to destroy the gonococci. As the discharge in this form of infection is extremely copious and is thrown off in amazing quantities, frequent cleansing of the eyes is necessary. Boric acid, sterile water, and normal salt solution are all excellent for this purpose. Stephenson<sup>1</sup> prefers mercury oxycyanid (1:4000) or potassium permanganate (1:2000). Whatever solution is selected, it should be warmed to body temperature before being used. As has been previously stated, the indication is to remove the discharge as soon as it is formed. In order to accomplish this, it is usually necessary, at least during the height of the malady, to make the applications hourly or even more frequently. Among private patients this requires the services of a day and a night nurse. Kalt<sup>2</sup> recommends frequent cleansing of the eyes by means of an irrigator, the rubber tube being attached to a small, expanded, trumpet-shaped nozzle. The latter is introduced between the lids and the discharge washed away. He employs 1 or 2 quarts of solution, warmed to body temperature, three or four times daily, and uses no other treatment. He reports good results. Needless to say, this treatment should not be intrusted to unskilled hands, and care should be taken not to cause an abrasion of the cornea. During the height of the disease ice-compresses are of benefit in reducing the swelling and pain. Theoretically, they are also of advantage in reducing the temperature of the conjunctiva to a point below which the gonococcus thrives. In all cases ice-compresses should be employed intermittently for at least the first twenty-four hours and in most cases longer. deSchweinitz<sup>3</sup> and Standish are strong advocates of the routine use of ice.

To destroy the gonococci the eyelids should be everted and the eye thoroughly washed with a cleansing solution, such as boric acid. The irrigation should be continued until all pus and fibrin have been removed. The lids and conjunctiva should then be lightly swabbed

<sup>1</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 231.

<sup>2</sup> Kalt: *Arch. d'Ophthalmologie*, 1894, vol. i, No. 14, p. 780.

<sup>3</sup> deSchweinitz, G. E.: *Therap. Gaz.*, January 15, 1907.



with a 1 per cent. solution of silver nitrate until a whitish film of coagulated albumin forms. The more severe the case, and the more copious the secretion, the stronger should be the solution of silver employed, but a 2 per cent. solution will invariably be found to be of sufficient strength. Especial care should be observed not to touch the cornea. The eye is then irrigated with physiologic salt solution until the white film has entirely been washed away. The lids are then turned back to their normal position and the sac once more irrigated. Ice-compresses may then be applied for five or ten minutes. This treatment should be applied daily, and should be administered by the physician or by a specially instructed nurse. The author favors the use of silver nitrate over all other drugs for the treatment of gonorrheal ophthalmia neonatorum. Argyrol, protargol, and other silver preparations have many advocates. Argyrol is the most popular of these preparations. Stephenson<sup>1</sup> invariably commences the treatment with a 25 per cent. solution of argyrol applied to the conjunctiva, repeating the application, according to the severity of the symptoms, one, two, three, or four times in the twenty-four hours. If decided improvement is not noted after three or four treatments, silver nitrate is employed. A corneal ulcer that does not heal under argyrol is another indication for the use of silver nitrate. One of the great advantages of argyrol is that the application may be safely intrusted to the infant's friends. When argyrol is to be employed, the eyes should be freely irrigated with the solution. According to deSchweinitz,<sup>2</sup> the immersion treatment of H. D. Bruns, which consists in building a dam about the eyes and then flooding them with solution, is one of the best methods of applying this drug. Argyrol possesses distinct cleansing properties, prevents the lids from becoming adherent, and seems to penetrate deeply between the folds of the edematous mucosa. Its employment does not prevent the use of silver nitrate, and, indeed, many authorities recommend that both drugs be used, the argyrol being applied four or more times in the twenty-four hours, and the silver, once or twice. This treatment, as a rule, gives excellent results. It must, however, be remembered that argyrol has no control over the specific nature of the disease. The application of silver should be continued until the discharge becomes thin and scanty and the gonococci have disappeared. It should then be applied two or three times a week until an entire cure has been effected, as proved by the absence of clinical symptoms and the results of bacteriologic examinations.

<sup>1</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907.

<sup>2</sup> deSchweinitz, G. E.: *Loc. cit.*, p. 4.



In this connection it is interesting to note that Groenouw<sup>1</sup> has found gonococci in the eyes twenty-five days after the discharge had ceased. This emphasizes the importance of making thorough bacteriologic examinations in every case before concluding that cure is complete.

If the disease is unilateral, the other eye should, of course, be protected from possible contamination. If corneal complications have not arisen, the average duration of gonorrheal ophthalmia neonatorum is about four to six weeks. The attendants on a case of gonorrheal ophthalmia should all be warned of the infectious nature of the discharge, and prophylactic measures, to safeguard them and others, should be instituted. Protective glasses, or ordinary motor goggles, are excellent shields against infection.

deSchweinitz<sup>2</sup> and Holloway<sup>3</sup> have both directed attention to the frequency of gonorrheal conjunctivitis, or, as it is termed, ophthalmoblebennorrhea or gonoblebennorrhea of young girls. This condition is frequently associated with epidemics of vulvovaginitis. It is produced either by auto-infection or by contamination from towels, clothing, or other articles. The symptoms are similar to those seen in ophthalmia neonatorum, and the treatment is the same.

**Gonorrheal Conjunctivitis in the Adult.**—This is generally the result of auto-infection, but may be systemic or caused by contamination from virulent, gonococci-bearing material from another individual. The disease is relatively less frequent among adults than among infants. Indeed, when one considers the number of cases of acute urethritis seen in the average genito-urinary dispensary, and their generally filthy personal hygiene and low mentality, it would almost seem as if the adult conjunctiva must possess, to some extent at least, a partial immunity to this organism.

**Symptoms.**—The symptoms of gonorrheal conjunctivitis in the adult usually appear in from twelve to forty-eight hours. The height of the disease is reached in about ten days, after which a gradual subsidence begins, lasting one or two months. In rare cases chronic conjunctivitis may persist longer. Gonorrheal conjunctivitis in adults is more serious, and the prognosis is distinctly less favorable than in a similar condition in infants. The symptoms, although generally similar, differ in some essentials. The chemosis of the bulbar conjunctiva is, as a rule, much more severe, corneal involvement is more frequent, and ulcers are of

<sup>1</sup> Groenouw: Graefe's Arch. f. Ophth., Leipzig, 1901, p. 1 (this article contains a review of the foreign literature to 1901).

<sup>2</sup> deSchweinitz, G. E.: Therap. Gaz., January 15, 1907.

<sup>3</sup> Holloway, T. B.: Jour. Amer. Med. Assoc., April 13, 1907, p. 1251.

even graver significance. There is a tendency for these ulcers to form at the point where the chemosed conjunctiva overlaps the limbus of the cornea. The prognosis is always grave. A fully developed case rarely recovers without some corneal involvement.

*Treatment.*—Treatment should be along the same general lines already suggested for gonorrheal ophthalmia neonatorum. Continuously applied ice compresses, especially for the first thirty-six hours, are of great benefit, and should, according to deSchweinitz, invariably be employed, provided the nutrition of the cornea is intact. Hosford and James<sup>2</sup> employ constant irrigation day and night by fastening a fine rubber tube to the forehead of the patient by means of adhesive plaster, and allowing a stream of 1:15,000 or 1:20,000 permanganate solution to trickle constantly across the palpebral fissure, encouraging the patient to open the lids every ten minutes. In the late stages of the disease these authors substitute zinc (8 grains to the ounce) for the permanganate.

In some cases of marked chemosis a hard ring of swollen and infiltrated tissue surrounds the cornea, which appears to be lying in a small pit. Radial incisions with a sharp Graefe knife through the entire depth of the indurated tissue give excellent results. If the chemosis and infiltration return, it may be necessary to repeat the incision on succeeding days. The scarification should be followed by a free boric-acid irrigation. Silver nitrate should be applied as previously described, except that a 1.5 or 2 per cent. solution should be employed. Atropin (4 grains to 1 ounce) to keep the pupils dilated and to lessen the tendency toward hyperemia of the uveal tract is indicated from the onset. If only one eye is affected, a Buller's shield should be applied to afford protection to the uninjured organ. This is a glass shield having adhesive plaster around the edges. The plaster is generally reinforced by a collodion dressing. If the pain is severe, morphin may be necessary. Especial attention should be directed to the patient's general condition, as relapses are of frequent occurrence if the general nutrition is not sustained. This is true of children as well as of adults.

**Metastatic Gonorrheal Conjunctivitis.**—Systemic gonorrhea may, in rare instances, result in ocular manifestations. In these cases the gonococci are probably carried as emboli to the minute vessels of the eye. Indeed, Galezowski<sup>3</sup> has seen a number of embolisms of the central retinal arteries in gonorrheal patients, which he considers

<sup>1</sup> deSchweinitz, G. E.: Therap. Gaz., January 15, 1907.

<sup>2</sup> Hosford, J. S., and James, G. B.: Lancet, January 13, 1912.

<sup>3</sup> Galezowski: Die ophthal. Klinik, 1900, vol. iv, p. 153.

to be localized thrombi of these vessels, due to accumulations of gonococci, and McKee<sup>1</sup> has demonstrated the presence of gonococci in an excised portion of conjunctiva; the organisms were chiefly under the epithelium. A gonorrheal septicemia was present. That this mode of infection is extremely rare is shown by Kurka,<sup>2</sup> who in 1902 reported the histories of 2 cases, and stated that they were the first observed in the Vienna clinic out of a material of over 20,000 new patients a year. Byers<sup>3</sup> believes the condition to be more frequent. Of the 109 cases of inflammation of the uveal tract and 38 cases of conjunctivitis collected from the literature by Byers,<sup>4</sup> all but 4 occurred in males. Burchardt,<sup>5</sup> Reyling,<sup>6</sup> Panas,<sup>7</sup> Cheatham,<sup>8</sup> and Frescoln<sup>9</sup> have referred to cases in women. In this large series the youngest patient was fifteen and the oldest sixty-eight years, the great majority of cases being between twenty and forty years of age.

*Symptoms.*—The condition usually originates in a posterior urethritis. Both eyes are commonly affected during the first attack. Relapses are prone to be unilateral. Other complications occurring simultaneously, such as arthritis or endocarditis, are of frequent occurrence. The clinical course is characterized by irregularity and uncertainty, both as to the severity of the symptoms and as to the extent to which the parts are involved. The discharge is slight in amount and mucoid in character.

Complications, such as affections of the other coats of the eye, occur in 30 per cent. of the patients. Relapses are not uncommon, and often result from a lighting up of the original focus of infection. The vascular coats of the eye are the most favorable points for lodgment of the gonococcus. Metastatic gonorrheal inflammation of the optic nerve has been described. Cases of dacryo-adenitis, which have been attributed to systemic gonorrheal infection, differ in no essential from the ordinary inflammation of the lacrimal gland. Sidler-Huguenin<sup>10</sup> has definitely proved the existence of metastatic iridocyclitis.

*Diagnosis.*—A diagnosis of metastatic gonorrhea of the conjunctiva is made with difficulty. The bilateral character of the disease, the

<sup>1</sup> McKee: *Ophthalmology*, 1907, vol. v, No. 4, p. 618.

<sup>2</sup> Kurka, A.: *Wien. klin. Woch.*, vol. xv, p. 1032.

<sup>3</sup> Byers, W. G. M.: *Studies from the Royal Victoria Hospital, Montreal*, vol. ii, No. 2 (*Ophthalmology*, 2), p. 24.

<sup>4</sup> Byers, W. G. M.: *Loc. cit.*, pp. 27 and 73.

<sup>5</sup> Burchardt: *Charité-Annalen*, 1894, vol. xix, p. 237.

<sup>6</sup> Reyling: *Langsdale's Lancet*, 1898, vol. iii, p. 4.

<sup>7</sup> Panas: *Rev. Gén. Méd. et de Therap.*, 1894, vol. lviii, p. 169.

<sup>8</sup> Cheatham: *Arch. of Ophthal.*, vol. xxv, p. 510.

<sup>9</sup> Frescoln, L. D.: *Brit. Med. Jour.*, March 25, 1911.

<sup>10</sup> Sidler-Huguenin: *Arch. f. Augenheilk.*, Wiesbaden, 1911, vol. lxix, p. 346.

absence, from the secretion, of gonococci and other bacilli which produce conjunctivitis, the comparative mildness of the subjective and objective symptoms, the absence of any history of gonorrheal material having come in contact with the eye, the presence of other manifestations of systemic gonorrhea and of gonorrhea in the genital tract, would arouse suspicion, and time would soon reveal the true nature of the disease if it were really one of contagious conjunctivitis.

Although ocular metastatic gonorrhea undoubtedly occurs, the extreme rarity of the condition should be considered, and the diagnosis, unless made by a skilled ophthalmologist, should be received with the utmost caution. It has been proved that gonococci may be present in the clear serous discharge from the genital tract, and since the distinction between the pathologic and the normal secretion is, at best, often only a relative one, this fact should be borne in mind in studying all cases believed to be of systemic origin.

*Treatment.*—The treatment of metastatic ocular gonorrhea differs in no essential from that usually employed for the cases suffering from the more common mode of infection, except that as the condition is systemic and the dangers of metastasis occurring in other parts of the body are to be considered, the patient should be confined to bed. Not infrequently metastatic ocular gonorrhea is the initial symptom of a gonorrheal septicemia. In this, as in other metastatic types associated with gonorrhea elsewhere in the body, treatment should be directed to the original source of the infection and to the patient's general condition, as reinfection may possibly occur.

The deeper coats of the eye are sometimes attacked by the gonococcus, either as the result of systemic or of contact infection. Eyre and Stewart,<sup>1</sup> Miller,<sup>2</sup> Shumway,<sup>3</sup> Hilbert,<sup>4</sup> Krause,<sup>5</sup> Prochaska,<sup>6</sup> and others have recorded the histories of cases of gonorrheal iritis, and Vandergrift<sup>7</sup> reports the history of a case of gonorrheal choroiditis. Causé<sup>8</sup> has referred to tenonitis, keratitis, iridocyclitis, iridochoroiditis, retinitis, neuroretinitis, and optic neuritis of gonorrheal origin. Campbell<sup>9</sup> has described a case of neuroretinitis. Pes<sup>10</sup> and Terson<sup>11</sup> have reported cases of bilateral purulent inflammation of the tear-sacs which they attributed to gonorrhea.

<sup>1</sup> Eyre and Stewart: *Lancet*, London, 1909, vol. ii, p. 76.

<sup>2</sup> Miller: *Glasgow Med. Jour.*, 1910, p. 232.

<sup>3</sup> Shumway: *Ann. Ophthalmology*, 1910, vol. xix, p. 23.

<sup>4</sup> Hilbert: *Zeit. f. prakt. Aerzte*, 1897, No. 7.

<sup>5</sup> Krause: *Berlin. klin. Wochenschr.*, 1904, p. 492.

<sup>6</sup> Prochaska: *Arch. f. path. Anat. u. Physiol. u. f. klin. Medizin*, 1901, p. 492.

<sup>7</sup> Vandergrift, G. W.: *Jour. Amer. Med. Assoc.*, June 8, 1912, p. 1756.

<sup>8</sup> Causé: *Zeit. f. Augenheilkunde*, Berlin, 1904, vol. xi, p. 399.

<sup>9</sup> Campbell: *Ann. d'ocul.*, 1896, vol. cxv, p. 47.

<sup>10</sup> Pes: *Die ophthal. Klinik*, 1898, vol. iii, p. 240. <sup>11</sup> Terson: *Ibid.*, 1900, p. 152.

Rollet and Aurand<sup>1</sup> have conducted an interesting series of experiments upon rabbits; they find that the gonococcus appears to possess a selective toxic action upon the nerve-cells of the retina and optic nerve. The lesions seem to be due to a toxin, as no gonococci were ever recovered from the lesions. Intra-ocular complications manifestly call for the services of the ophthalmologist, and are, therefore, not dealt with in this work. The author is of the opinion that a skilled ophthalmologist should, if possible, be in attendance upon all gonorrheal lesions of the eye; for although the obstetrician may carry out the routine treatment carefully, complications may arise at any time that one especially skilled in the study of eye diseases is more capable of dealing with satisfactorily than are those who, perhaps, see such conditions only occasionally.

<sup>1</sup> Rollet and Aurand: *Rev. Gén. d'Ophtal.*, 1912, No. 3.

## CHAPTER XVIII

### GONORRHEAL SEPTICEMIA, BACTEREMIA, AND TOXEMIA.— GONORRHEA OF THE OSSEOUS AND CIRCULATORY SYSTEMS

#### GONORRHEAL SEPTICEMIA, BACTEREMIA, AND TOXEMIA

THAT gonorrhea can no longer be regarded as a purely local disease modern research has amply proved. Much of this work has been done in France. The French use the term "gonohemia" to describe the condition when the circulatory system is involved. By bacteriologic experiments it has been shown that the gonococcus grows best in a medium that contains blood or its derivatives. It is not surprising, therefore, to find that, under certain circumstances, virulent gonococci may be found in the circulating blood. Thayer and Blumer<sup>1</sup> were the first to demonstrate these microorganisms in pure culture in the blood-stream during life. Since then numerous observers have recovered the organisms from the blood, and gonorrheal septicemia has become an established clinical entity. Three theories accounting for the existence of general gonorrheal infection have been advanced: The first is that the infection occurs through the blood; the second, that it occurs through the lymphatic system; and the third, that the results are due to the presence of toxins. It is likely that all three channels are sometimes factors in the causation. Hematogenous infection is probably the most frequent. The exact part played by the lymphatics in general gonorrheal infection is still undetermined, although Uysing<sup>2</sup> and others have demonstrated the presence of the gonococcus in the lymph-stream. Undoubtedly, gonorrheal toxemia exists, but the fact that the specific microorganism cannot always be demonstrated in a certain lesion does not by any means prove the absence of a septicemia, as, apart from the difficulty often encountered in the bacteriologic and microscopic demonstration of these microorganisms, it has been amply proved that the gonococci in many instances disappear from encapsulated fluid after varying intervals. This peculiarity of the gonococcus doubtless accounts for the many cases in which the specific microorganism cannot be demonstrated in

<sup>1</sup> Thayer and Blumer: *Arch. de méd. expér. et d'anat. path.*, Paris, November, 1895; also *Johns Hopkins Hosp. Bull.*, 1896, vol. vii, p. 57.

<sup>2</sup> Uysing: *Inaug. Dissert.*, Kiel, 1900.

the fluid from cases of arthritis and endocarditis, etc. Zieler<sup>1</sup> believes that all general gonorrheal infections begin as septicemias, but that the organisms often disappear rapidly from the blood-stream or are present only in such small numbers that their demonstration is almost impossible.

From a study of the recorded cases it would seem that toxemias are, as a rule, less severe than septicemias. Probably a considerable proportion of certain of the mild lesions, such as the mild skin eruptions; lesions of the nervous system, peripheral and central; mild cases of optic neuritis and retinitis, and even in some instances conjunctivitis, as well as the various other better known conditions, may be due to toxemias.

Despite the numerous recorded cases, gonorrheal septicemia is relatively infrequent when we consider the prevalence of genital gonorrhea, although Thayer observed 10 cases within a period of six years in the Johns Hopkins Hospital. Cholzow,<sup>2</sup> Margan,<sup>3</sup> Prochaska<sup>4</sup> (3 cases), Himmelheber,<sup>5</sup> Krause<sup>6</sup> (2 cases), Dieulafoy,<sup>7</sup> Sowinsky,<sup>8</sup> Faure-Beaulieu,<sup>9</sup> Wynn,<sup>10</sup> Weitz,<sup>11</sup> Zieler,<sup>12</sup> Rey,<sup>13</sup> Rotky,<sup>14</sup> Hodara, Osman, Izzit and Chevet,<sup>15</sup> Thevenot and Michel,<sup>16</sup> and Moorhead<sup>17</sup> have recorded cases in which undoubted gonococci have been recovered from the circulating blood-stream. Doubtless many cases are overlooked, owing to the fact that but little attention has been paid to this condition, and also that gonorrheal septicemia often becomes manifest after the acute symptoms of the original infection have disappeared; indeed, in many cases when the bacteriologic nature of the septicemia has been established beyond question, it has been only with the greatest difficulty that the specific microorganisms have been demonstrated

<sup>1</sup> Zieler, K.: *Mediz. Klinik*, February 11, 1912.

<sup>2</sup> Cholzow, B. N.: *Zeitschr. f. Urologie*, 1911, vol. v, No. 12.

<sup>3</sup> Margan: *La Sem. Méd.*, 1910, p. 261.

<sup>4</sup> Prochaska: *Virchow's Arch.*, 1901, vol. clxiv, p. 492; also *Arch. f. path. Anat. u. Physiol. u. f. klin. Medizin*, 1901, p. 492.

<sup>5</sup> Himmelheber: *Med. Klinik*, 1907, No. 96.

<sup>6</sup> Krause, P.: *Berlin. klin. Wochenschr.*, May 9, 1904, No. 19, p. 494.

<sup>7</sup> Dieulafoy: *La Sem. Méd.*, 1909, p. 238.

<sup>8</sup> Sowinsky, S. W.: *Dissert. St. Petersburg*, 1901.

<sup>9</sup> Faure-Beaulieu: *Thèse de Paris*, 1906; *ref. La Sem. Méd.*, 1907, p. 30.

<sup>10</sup> Wynn: *Lancet*, February 11, 1905, p. 352.

<sup>11</sup> Weitz: *Mediz. Klinik*, February 4, 1912.

<sup>12</sup> Zieler, T.: *Mediz. Klinik*, February 11, 1912.

<sup>13</sup> Rey, C.: *Bull. Soc. méd. d'hôp. de Lyon*, 1912, vol. x, p. 315; also *Lyon Méd.*, 1912, vol. cxviii, p. 1169.

<sup>14</sup> Rotky, K.: *Wien. klin. Wochenschr.*, 1912, No. 3, p. 1187.

<sup>15</sup> Hodara, Osman, Izzet and Chevet: *Gaz. Méd. d'Orient*, June, 1911, p. 143.

<sup>16</sup> Thevenot, L., and Michel, P.: *La Province Méd.*, 1912, No. 20, p. 228.

<sup>17</sup> Moorhead, G. I.: *Med. Presse*, 1912, vol. xciii, p. 355.



in the original lesion. A further source of error is the well-known difficulty with which gonococci are grown upon an artificial medium, so that unless the bacteriologist who takes the blood-cultures employs a medium especially adapted to the growth of the gonococcus, no cultures will be obtained. A further difficulty in establishing the etiologic relationship of the gonococcus in these cases is the fact that the microorganisms are usually present only in small numbers.

Septicemia generally follows gonorrhea of the genital organs, as this is the most frequent locality for the infection to occur. Brehmer,<sup>1</sup> Hoeck,<sup>2</sup> Widmark,<sup>3</sup> Chartres,<sup>4</sup> Stevens,<sup>5</sup> Stephenson,<sup>6</sup> Höck,<sup>7</sup> and others have, however, reported the histories of cases of general septicemia that followed a gonorrheal eye lesion. Gonorrheal septicemia, bacteremia, and toxemia are far more frequent among males than among females. In a large proportion of cases the gonococci have disappeared from the anterior urethra, the site of the infection being the prostate or the seminal vesicles. Thus Ulmann<sup>8</sup> reports 5 fatal cases, in 4 of which the focus of infection was a prostatic abscess. Children and pregnant women seem to offer a more fertile soil for the development of gonorrheal septicemia than do non-gravid females. Kimball<sup>9</sup> has recorded the histories of 8 cases, in none of which the patients were over three months of age; 6 proved fatal. The mode of entrance of the gonococcus to the circulating blood has not as yet been definitely determined. Some loss of continuity in the infected mucosa is the probable entrance point in the majority of cases. Leede<sup>10</sup> reports the history of a case in which he believes a chancre was the point of entrance for the gonococci. This author is of the opinion that the gonococci were carried from the chancre by the lymphatics and conveyed thence to the blood. Purulent gonorrheal arthritis, fatty degeneration of the heart, and other evidences of a general infection were present. Leede quotes a somewhat similar case, the history of which has been recorded by Jadassohn. The theory of loss of continuity is well borne out by a study of the reported cases that have come to autopsy, in nearly all of which a local focus of suppuration, in the deep urethra, the deep peri-

<sup>1</sup> Brehmer, C.: *Deut. med. Wochenschr.*, Leipzig and Berlin, 1905, vol. xxxi, p. 64.

<sup>2</sup> Hoeck: *Jahresb. der Ophth.*, 1894, p. 531.

<sup>3</sup> Widmark: *Rev. Gén. d'ophtalmologie*, April 30, 1888.

<sup>4</sup> Chartres: *Thèse de Bordeaux*, 1897, p. 27.

<sup>5</sup> Stevens: *Ophthalmic Record*, November, 1905.

<sup>6</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 143.

<sup>7</sup> Höck, H.: "Ein Beitrag zur Arthritis blennorrhœica," *Wien. klin. Woch.*, 1893, vol. vi, p. 736.

<sup>8</sup> Ulmann: *Deut. Arch. f. klin. Med.*, 1901, vol. lxi, p. 309.

<sup>9</sup> Kimball, R. B.: *Med. Record*, November 14, 1903, p. 461.

<sup>10</sup> Leede: *Münch. med. Woch.*, February 28, 1911, p. 466.

urethral tissues, or the pelvis, has been present. This focus may in some instances be extremely small, as in a case related by Thayer,<sup>1</sup> in which the only etiologic factor was a prostatic abscess a few centimeters in diameter. Zieler<sup>2</sup> states that anything that has a tendency to aggravate an acute gonorrheal catarrh favors sepsis, *i. e.*, trauma, especially from unskillful instrumentation, alcoholic or venereal excesses, menstruation, pregnancy, ill-advised treatment, and general constitutional diseases, such as tuberculosis, diabetes, or any condition that lowers the general vitality. Kimball,<sup>3</sup> after carefully reviewing the histories of 10 cases of septicemia that occurred in infants or young children, suggests the possibility of the condition occasionally arising from a stomatitis neonatorum, as in 8 of his cases no gonococci could be demonstrated in the genital tract. Taking into consideration the difficulty often encountered in recovering the gonococci from the vagina in chronic cases, such a route of infection, although possible, should be regarded with caution.

Systemic infection may arise in any case of gonorrhea, no matter how mild, but, as has previously been stated, the malady generally appears during the chronic stage of the original infection, and is often accompanied by a cessation of local symptoms; although Irons<sup>4</sup> reports the history of a case in which the septicemia developed within seven days of the appearance of the initial attack. Mixed infection is not uncommon, the associated organisms most frequently present being the colon bacillus, the streptococcus, the staphylococcus, or some of the other common pyogenic microorganisms. Among 10 cases studied by Thayer,<sup>5</sup> in all of which gonococci were positively identified by cultures from blood *intra vitam*, from local lesions at necropsy, or by both methods, 3 showed a mixed infection. Lofaro<sup>6</sup> has studied the question of whether, in ordinary cases of genital gonorrhea, the microorganisms are to be found in the blood. Sixty-seven cases were examined, and the specific microorganisms were found in the blood of 39. These were mostly cases of urethritis, either acute or chronic. In none of the acute cases were the gonococci demonstrated in the circulation. Lofaro believes that it is only when extremely virulent bacteria are present, or when the soil is especially suitable, that the gonococci enter, or, at all events, thrive in the blood. Further investigation on this subject is required, as it has previously been the

<sup>1</sup> Thayer: Amer. Jour. Med. Sci., 1905, p. 752.

<sup>2</sup> Zieler, R.: Med. Klinik, Berlin, February, 1912, vol. viii, No. 6.

<sup>3</sup> Kimball, R. B.: Med. Record, New York, November 11, 1903, p. 761.

<sup>4</sup> Irons: Abst. Amer. Jour. Urology., 1910, vol. vi, p. 246.

<sup>5</sup> Thayer: Amer. Jour. Med. Sci., November, 1905.

<sup>6</sup> Lofaro, F.: Il Policlin., February, 1911.

common belief that the gonococci do not flourish in the general circulation under ordinary conditions, a conclusion that seems to be borne out by the clinical fact that in many cases of gonorrhea no metastatic complications are encountered.

**Symptoms.**—In gonorrheal septicemia, bacteremia, or gonotoxemia no organ or tissue in the body is immune, although the microorganism appears to possess a special predilection for the various serous membranes, such as the endocardium, pericardium, pleura, peritoneum, meninges, and synovial tissues. As a result, the symptoms may vary widely in different cases.

As has been mentioned elsewhere, all gonococcal lesions that are distant from the point of original infection, such as arthritis, endocarditis, etc., are manifestations of a general infection. Many of such cases can, however, be classed under the heading of the so-called metastatic infections, that is, the gonococci or the toxins are carried to a particular location and there produce local symptoms, and are not accompanied by the usual evidences of what is generally termed septicemia, bacteremia, or toxemia. Such cases are discussed under a separate heading. On the other hand, as would be expected, many true septicemias are accompanied by an arthritis or other local conditions.

Usually the symptoms of a general gonococcal infection are similar to those produced by pyogenic microorganisms in general. The systemic infection is often ushered in by a cessation or subsidence of local symptoms. At the onset systemic disturbances, such as malaise, feverishness, headache, nausea or vomiting, and backache, and other manifestations of constitutional infection, may be present. The initial symptom of the attack is often a chill, which may be followed by high temperature of irregular range, profuse sweats, delirium, stupor passing into coma, and death. Smith<sup>1</sup> and others have called attention to the marked fluctuations in temperature that may be present. The similarity to typhoid fever in some instances is striking, as exemplified in the cases reported by Dieulafoy,<sup>2</sup> Irons,<sup>3</sup> and Thayer.<sup>4</sup> An eruption appearing over the abdomen, thorax, thighs, arms, or neck may be an early symptom. It may be polymorphic, and at first is often rose colored, slightly elevated, and disappears on pressure. It appears in the form of crops, later not infrequently becoming papular and suggestive of syphilis, or resembling the eruption produced by the ingestion of balsamic drugs. Gonococci have been demonstrated in the eruption.

<sup>1</sup> Smith, J. T.: *Cleveland Med. Jour.*, 1911, No. 10, p. 810.

<sup>2</sup> Dieulafoy: *Internat. Clinics*, vol. iii, nineteenth series, p. 59.

<sup>3</sup> Irons: *Abst. Amer. Jour. Urology*, 1910, vol. vi, p. 264.

<sup>4</sup> Thayer: *Amer. Jour. Med. Sci.*, November, 1905.

Figueras<sup>1</sup> refers to a case of gonorrheal septicemia that had been mistaken for malaria. Joehmann<sup>2</sup> states that the spleen is usually enlarged, and that albuminuria is often present. Chevrel<sup>3</sup> has reported a case in which the fever was markedly intermittent. The fever may be high and irregular, or the temperature may be slightly elevated and continuous throughout, depending upon the virulence of the micro-organism and the resisting power of the patient. Mixed infections, especially when the streptococcus is present, are usually productive of the most severe symptoms. Padula<sup>4</sup> has called attention to the mild continued fever that is sometimes present in clinically uncomplicated cases of gonorrhea of the genito-urinary tract, and suggests that these may be due to a mild systemic infection. Indeed, Zieler<sup>5</sup> states that in mild cases the septicemia is frequently overlooked. Profuse sweats are, as a rule, present. Sudamina may result. The pulse becomes rapid and weak and often dirotic. The heart-sounds become feeble. The first sound is especially weak, and resembles the second. Nausea or vomiting may be a marked symptom or may be entirely absent. Diarrhea is generally present, although it is not a constant symptom. As the disease progresses weakness, anemia, loss of weight, and in severe cases low, muttering delirium, subsultus tendinum, carphologia, or coma-vigil may be observed. Examination of the blood reveals the presence of the gonococcus if the case be one of septicemia. Weitz<sup>6</sup> has reported the history of an interesting case in which acute atrophy of the liver occurred. Jaundice appeared three days before death.

Leukocytosis is always present. The white blood-corpuscles vary in number from 10,000 to 30,000 or more. A differential count in Dieulafoy's<sup>7</sup> case showed the following: Polynuclears, 71 per cent.; lymphocytes, 18 per cent.; large mononuclears, 10 per cent.; eosinophiles, 1 per cent.; white blood-corpuscles, 16,000; hemoglobin, 0.42 per cent. As a result of the presence of living gonococci in the general circulation, various other complications are frequently present. Of these, arthritis is perhaps the most common. Faure-Beaulieu<sup>8</sup> records this condition as occurring 26 times in a series of 34 cases of gonorrheal septicemia. Cole<sup>9</sup> observed endocarditis 11 times in a series of 29 cases

<sup>1</sup> Figueras: *La Prensa Médica*, March 15, 1911.

<sup>2</sup> Joehmann: *Berlin. klin. Woch.*, March 4, 1912.

<sup>3</sup> Chevrel, F.: *Progrès Méd.*, Paris, 1912, vol. xxviii, p. 281.

<sup>4</sup> Padula: *Febbre infettiva da virus blennorrhagico*, Rome, Svo, 1892.

<sup>5</sup> Zieler, K.: *Med. Klinik*, February 11, 1912.

<sup>6</sup> Weitz: *Med. Klinik*, 1912.

<sup>7</sup> Dieulafoy: *Internat. Clinics*, vol. iii, nineteenth series, p. 61.

<sup>8</sup> Faure-Beaulieu: *Thèse de Paris*, 1906; ref. in *La Sem. Méd.*, 1907, p. 30.

<sup>9</sup> Cole, R. L.: *Osler's Modern Medicine*, vol. iii, p. 94, Philadelphia, 1907.

of gonorrheal septicemia. Other complications often occur. The prognosis depends largely upon the complications that are present. Mixed infections are, as a rule, the more virulent, the most fatal microorganisms being the streptococcus. The prognosis, even in the mildest cases, should be guarded, for severe or lethal complications may arise at any time. Relapses are not infrequent. Chartres,<sup>1</sup> Rothrock,<sup>2</sup> Stevens,<sup>3</sup> Tie and Sigaud,<sup>4</sup> Stephenson,<sup>5</sup> and many others record deaths from this condition. Of Cole's<sup>6</sup> collected series of 29 cases, 12 died, 16 recovered, and in 1 the result was not stated. Excellent papers on general gonorrheal infection by Schneider,<sup>7</sup> v. Hoffman,<sup>8</sup> and Sturgis<sup>9</sup> have appeared.

**Diagnosis.**—The diagnosis of gonorrheal septicemia depends entirely upon the demonstration of the specific microorganism in the circulating blood-stream. It should be remembered that in the majority of cases the primary lesion is a chronic one, or that it may have subjectively disappeared. General gonorrheal infections cannot be positively differentiated from other forms of infection unless a bacteriologic examination of the blood is made.

**Treatment.**—This consists, when possible, of the eradication of the disease from its primary source, for reinfection may occur. A septicemia in the female generally originates from an intrapelvic lesion, often from a salpingitis. As regards the necessity for immediate operation the surgeon must be governed largely by the condition of the individual patient. Rest in bed and a sustaining, easily assimilable, alcohol-free diet are indicated. Cold packs or baths may be employed to combat pyrexia. The bowels should be regulated, and the use of the bed-pan enforced. As pneumonia and pleurisy are not uncommon complications, a woolen jacket should be worn. Strychnin is not infrequently required, as cardiac fatigue often occurs; in some cases opium is necessary to relieve pain. In the majority of cases symptomatic treatment is indicated. Zieler<sup>10</sup> recommends intravenous injections of collargol. Marchildon<sup>11</sup> states that the method of injection is similar to that employed for salvarsan. A 1 per cent.

<sup>1</sup> Chartres, E.: Thèse de Bordeaux, 1896, p. 27.

<sup>2</sup> Rothrock, J. L.: St. Paul Med. Jour., 1911, vol. xiii, p. 494.

<sup>3</sup> Stevens, E. W.: Ophthalmic Record, November, 1905.

<sup>4</sup> Tie and Sigaud: Lyon Méd., 1911, vol. exvi, p. 933.

<sup>5</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 143.

<sup>6</sup> Cole, R. I.: Osler's Modern Medicine, vol. iii, p. 94, Philadelphia, 1907.

<sup>7</sup> Schneider: Zeit. f. Heilk., 1901, No. 10.

<sup>8</sup> v. Hoffman: Centralbl. f. d. Grenzgeb. d. Med. u. Chir., 1903, vol. vi, No. 7.

<sup>9</sup> Sturgis: St. Louis Courier of Med., July, 1901.

<sup>10</sup> Zieler, K.: Med. Klinik, February 11, 1912.

<sup>11</sup> Marchildon, J. W.: Jour. Missouri State Med. Assoc., November, 1912, p. 141.

solution of collargol is prepared in physiologic salt solution, and 10 c.c. of this is injected into a vein of the arm daily for three or four days. When the gonococidal properties of collargol are considered (see Chapter XX) and the necessary dilution that must occur in the blood, this would not appear to be a very useful form of treatment. Complications should be guarded against, and when they arise, require especial treatment. Pus should be evacuated as soon as possible.

#### BONE AND JOINT LESIONS PRODUCED BY GONORRHEA

The relationship between arthritis and gonorrhea was recognized by many of the early writers. The work of Brande<sup>1</sup> is perhaps the clearest and most convincing of the earlier writings on the subject. Lindermann<sup>2</sup> was the first to demonstrate the presence of gonococci in pure culture from a case of arthritis, and thus positively established the clinical existence of this condition. Similar results were obtained by Höck<sup>3</sup> in the following year.

**Gonorrheal Arthritis.**—Gonorrheal arthritis, like gonorrhea of the heart, lungs, pleura, or other structures remote from the original point of infection, is merely a local manifestation of a general infection, the gonococci being transmitted by the blood-stream from the primary focus to other areas in the body, and there finding lodgment and producing their characteristic lesions. Just why certain organs and joints are selected in a given case is not known. The experiments of Lofaro,<sup>4</sup> which have previously been referred to, are of particular interest in this connection. This observer has shown that in a considerable proportion of cases of chronic gonorrhea in which only genital lesions are apparently present gonococci may be recovered from the circulating blood. That a loss of continuity at the site of the original infection is a predisposing factor to a gonorrheal septicemia seems to be well established, but this alone is not sufficient evidence to explain the causation of a general infection, as arthritis is undoubtedly present in many cases in which no gonococci can be demonstrated in the circulation at the time when the articular lesions become manifest. Lofaro explains this circumstance on the grounds of individual susceptibility of the patient and the degree of virulence of the particular microorganism. In the majority of cases the gonococci have probably disappeared from the general circulation by the time the articular symptoms have become manifest. Whatever the cause, the fact that cases of arthritis

<sup>1</sup> Brande: *Arch. gén. de méd.*, Paris, 1854, vol. ii, p. 257.

<sup>2</sup> Lindermann: *Beit. z. Augenh.*, Hamburg and Leipzig, 1892, p. 31.

<sup>3</sup> Höck: *Wien. klin. Woch.*, 1893, vol. iv, p. 739.

<sup>4</sup> Lofaro, F.: *Il Policlinico*, February, 1911.



or endocarditis, etc., are in reality general infections should not be lost sight of, as the prognosis and treatment are largely dependent upon this point.

Gonorrheal arthritis is a metastatic infection, and may follow primary gonorrhea of any organ in the body, or, less frequently, may be caused by a toxemia. It generally occurs secondarily to urethritis, vulvovaginitis, or ophthalmia, and usually becomes manifest during the chronic stage of the original infection. Griffon<sup>1</sup> states that in exceptional cases articular symptoms may precede the subjective symptoms at the original site of the infection. This, however, is very rare. Resnikow<sup>2</sup> has described a case in which a sixteen-year-old girl developed urethritis and arthritis four days after marriage to a man suffering from gonorrhea. Arthritis secondary to eye lesions has been described by Lucas,<sup>3</sup> Fenwick,<sup>4</sup> Deutschmann,<sup>5</sup> Hoeck,<sup>6</sup> Haushalter,<sup>7</sup> Paulsen,<sup>8</sup> Altland,<sup>9</sup> Stephenson,<sup>10</sup> and others. With the onset of articular symptoms the manifestations of the primary lesion generally subside, the discharge and pain decreasing. This does not indicate that the primary lesion is cured, as symptoms from it usually recur as the arthritis improves.

According to some authorities, trauma is a frequent predisposing factor to gonorrheal arthritis. The arthritis itself is prone to recur, and one attack apparently predisposes to subsequent seizures. Recurrence frequently follows reinfection or the lighting up of a chronic lesion. Slight trauma, such as is inflicted by the passage of a sound or too vigorous treatment, is often followed by a recurrence of joint trouble. Arthritis may occur at any time during the course of a gonorrhea, but is most often encountered about two to eight weeks after infection—in other words, during the chronic stage of the primary disease. The disease may be monoarticular or polyarticular, the latter being the most frequent condition. Jullien<sup>11</sup> reports 348 cases, of which 143 were monoarticular. Baer<sup>12</sup> states

<sup>1</sup> Griffon: Quoted by Dieulafoy: *Text-book of Medicine*, vol. ii, p. 1996; Baillière, Tindall, and Cox, London, 1910.

<sup>2</sup> Resnikow: Quoted by Cole: *Osler's Modern Medicine*, 1907, vol. iii, p. 103.

<sup>3</sup> Lucas, R. C.: *Brit. Med. Jour.*, February 28, July 11, and October 10, 1885.

<sup>4</sup> Fenwick, R. G.: *Brit. Med. Jour.*, October 31, 1885.

<sup>5</sup> Deutschmann: *Von Graefe's Arch. f. Ophthal.*, 1890, vol. xxxvi, p. 109.

<sup>6</sup> Hoeck: *Jahresb. der Ophthal.*, 1894, p. 531; also *Wien. klin. Woch.*, October 12, 1893, p. 736.

<sup>7</sup> Haushalter: *La Sem. Méd.*, 1895, vol. xv, p. 380.

<sup>8</sup> Paulsen: *Münch. med. Wochenschr.*, August 28, 1900.

<sup>9</sup> Altland: *Klin. Monatsbl. f. Augenheilk.*, April, 1902.

<sup>10</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 142.

<sup>11</sup> Jullien: Quoted by E. Finger: *Wood's Med. and Surg. Monographs*, New York, 1889, p. 294.

<sup>12</sup> Baer, A. N.: *Amer. Jour. Dermat.*, vol. xii, 1908, p. 14.



that in 66 per cent. of all cases more than one joint is involved. Cole<sup>1</sup> cites the histories of 50 cases, all but 3 of which were polyarticular. The statistics of Markheim<sup>2</sup> and of Bloodgood<sup>3</sup> show that the disease was polyarticular in from 56 per cent. to 60 per cent. of cases. Bloodgood, however, states that, on admission to the hospital, more than one joint was affected in only 11 per cent. of cases. In the early stages more than one joint is usually attacked; later the disease exhibits a tendency to be monoarticular.

The combined statistics of Northrup, Finger, and Bennecke,<sup>4</sup> comprising 704 cases, show that the joints were involved in the following order of frequency:

	NORTHROP	FINGER	BENNECKE	TOTAL
Knee . . . . .	91	136	31	258
Ankle . . . . .	57	59	9	125
Wrist . . . . .	27	43	6	76
Elbow . . . . .	18	25	10	53
Shoulder . . . . .	16	24	4	44
Hip . . . . .	16	18	8	42
Temporomaxillary . . . . .	2	14	..	16
Small joints of foot . . . . .	40	..	6	46
Heel and toes . . . . .	21	..	..	21
Small joints of hand . . . . .	11	35	4	50
Sternoclavicular . . . . .	3	..	..	3
Other articulations . . . . .	..	21	..	21

The wrist is attacked more frequently in women than in men. In some cases the disease may originate as a monoarticular lesion and subsequently attack other joints. Like gonorrheal septicemia, gonorrheal arthritis is more frequent in men than in women, and, indeed, is seldom observed in females except during pregnancy or the puerperium. Children are by no means immune, joint lesions frequently following a vulvovaginitis. Holt<sup>5</sup> states that a pyemic arthritis in a young infant is more frequently due to the gonococcus than to any other microorganism.

In 1899 Lucas<sup>6</sup> was able to collect the histories of 23 cases of gonorrheal joint lesions occurring in infants or young children, all of which were secondary to ophthalmia. Of 223 cases of arthritis reported by Weiss,<sup>7</sup> 117 occurred in men, 76 in women, and 30 in children. Of Northrup's 252 cases, 230 were men and only 22 women. Of 50 cases

<sup>1</sup> Cole: Osler's Modern Medicine, 1907, vol. iii, p. 103.

<sup>2</sup> Markheim: Quoted by Young, J. K.: Manual and Atlas of Orth. Surgery, Philadelphia, 1905, p. 528.

<sup>3</sup> Bloodgood: Quoted by Young, J. K.: Manual and Atlas of Orth. Surgery, Philadelphia, 1905, p. 528.

<sup>4</sup> Northrup, Finger, and Bennecke: Quoted by Young, J. K.: Manual and Atlas of Orthopedic Surgery, Philadelphia, 1905, p. 529.

<sup>5</sup> Holt: Trans. New York Acad. Med., 1905.

<sup>6</sup> Lucas, R. C.: Med.-Chir. Trans., published by the Roy. Med. and Chir. Soc., London, vol. lxxxii (second series, vol. lxiv), 1899, p. 137.

<sup>7</sup> Weiss: Quoted by Cole, R. I.: Osler's Modern Medicine, 1907, vol. iii, p. 162.

seen in the Johns Hopkins Hospital, only 7 were females. Kimball,<sup>1</sup> Haushalter,<sup>2</sup> Heilman,<sup>3</sup> Altland,<sup>4</sup> Witherspoon,<sup>5</sup> and others<sup>6</sup> have recorded cases in infants or adults who were suffering from gonorrheal ophthalmia.

Lovett<sup>7</sup> describes the following types of arthritis: (1) Arthralgia without definite lesion in the joints; (2) acute serous synovitis with much periarticular swelling; (3) acute fibrinous or plastic synovitis with slight effusion; (4) chronic serous or purulent synovitis, and (5) involvement of periarticular structures, such as bursæ and tendon-sheaths. These forms gradually merge into one another, and there is no sharp dividing-line between them. The condition may be acute or subacute from the onset, or one condition may follow the other. Sever<sup>8</sup> states that gonorrhea is followed in over 10 per cent. of cases by joint involvement. Clark<sup>9</sup> places the proportion at 2 per cent. Baer<sup>10</sup> found arthritis in from 1.5 per cent. to 3 per cent. of all cases. In statistics compiled from women alone, this proportion is much lower even than Baer's figures.

**Symptoms.**—These usually consist, at first, of pain in several joints, which in a few days becomes localized to one or more areas and disappears from the others. The pain is frequently first noticed by the patient in the morning. In some instances, as in the cases recorded by Adams,<sup>11</sup> the onset is sudden, but more frequently premonitory symptoms arise. Moderate elevation of temperature, occasionally preceded by a chill, and the accompanying symptoms of fever, are usually observed, and are always present in the acute cases. The acute stage commonly lasts three or four weeks. The affected joints become swollen and tender, more or less edema is present, and fluctuation may be marked. The pain, which varies in degree in different cases, is augmented by motion, and is often more severe at night than during the day. The fascia and tendons of the joints are involved, and tenderness of adjacent muscles is present. Muscular spasms occur, and the joint assumes a partially flexed position. If the effusion is serous, the local condition may not progress beyond the stage just described.

<sup>1</sup> Kimball: *Med. Record*, November 14, 1903.

<sup>2</sup> Haushalter: *La Sem. Méd.*, 1895, vol. xv, p. 380.

<sup>3</sup> Heilman: *Med. Record*, August 28, 1900.

<sup>4</sup> Altland: *Klin. Monats. f. Augenheilk.*, April, 1902.

<sup>5</sup> Witherspoon, J. A.: *Jour. Amer. Med. Assoc.*, February 2, 1907, p. 377.

<sup>6</sup> Editorial, *Amer. Med.*, April 25, 1903.

<sup>7</sup> Lovett, R. W.: *Keen's Surgery*, 1907, p. 304.

<sup>8</sup> Sever, J. W.: *Poston Med. and Surg. Jour.*, May 16, 1912, p. 727.

<sup>9</sup> Clark, J. B.: *Essays on Genito-Urinary Subjects*, New York, 1912, p. 64.

<sup>10</sup> Baer, A. N.: *Amer. Jour. Dermat.*, 1908, vol. xii, p. 14.

<sup>11</sup> Adams: *Amer. Jour. Dermat.*, 1908, vol. xii, p. 6.

More frequently, however, the disease advances, and the joint becomes extremely swollen and exquisitely tender. Ankylosis, generally fibrous, with the limb in a more or less abnormal position, and atrophy of the involved muscles, may occur. Kienböck<sup>1</sup> believes that neuritis is a frequent accompaniment of arthritis. Polyneuritis is probably the cause of many of the severe muscular atrophies that are not infrequent in this disease. Disuse alone can hardly be considered sufficient cause to explain the extent of many of these atrophies. A rare sequela, sometimes observed in chronic cases, is an overstretching of the ligaments, which results in abnormal mobility. Anemia is generally present in chronic cases. If suppuration results, the skin over the affected areas becomes reddened, and the acute symptoms, both local and general, increase in severity. Rupture of the synovial membrane, with the formation of extra-articular abscesses, which may later burst at the point of least resistance, are not infrequent in neglected cases. Ware<sup>2</sup> has described the history of a case complicated by the presence of an abscess outside the joint.

Death occasionally results from general infection. Jordan<sup>3</sup> has recorded the history of a case in which the right wrist was affected. The nails of the right hand were dark brown and deeply furrowed by a transverse groove, this condition appearing shortly after the arthritis and tending to disappear when the articular symptoms improved. Jordan believed, therefore, that the condition of the nails was a manifestation of the gonorrheal arthritis. This was not proved. Generally in the acute form, and not infrequently in the chronic stages, gonococci can be demonstrated in the joint effusion. They may be found free in the fluid or in the epithelium or pus-cells of the effusion. The specific microorganism can, however, be recovered much more constantly from the granulation tissue of the synovial membrane than from the fluid, being absent from the latter in a certain proportion of cases. It is well recognized that long-encapsulated gonococci tend to disappear, as witness the sterile contents of many undoubted gonorrheal tubal lesions. The more early, therefore, the fluid is examined during the course of the disease, the more likely are gonococci to be found.

It is undoubtedly true that purulent collections are frequently the result of a mixed infection, but the view formerly held, that all such cases were mixed infections, is no longer tenable, as shown by the bacteriologic studies of Young,<sup>4</sup> who demonstrated conclusively that this condition was in many cases due to the gonococcus in pure culture.

<sup>1</sup> Kienböck, R.: *Samml. klin. Vort., Innere Med.*, No. 92, Leipzig, 1901, p. 533.

<sup>2</sup> Ware: *New York Med. Jour.*, January 13, 1906.

<sup>3</sup> Jordan: *Editorial in Amer. Jour. Dermat.*, 1909, vol. xiii, p. 159.

<sup>4</sup> Young, H. H.: *Johns Hopkins Hosp. Reports*, vol. ix, p. 677.

**Diagnosis.**—This rests largely on the history of the case and on the detection of the original site of the infection. The conditions with which gonorrheal arthritis are most likely to be confused are rheumatism and tuberculosis. From the former it may be distinguished by its extreme chronicity, the tendency to form ankylosis, the smaller number of joints involved, especially during the late stage of the disease, and the fact that arthritis may attack the temporomaxillary, the sternoclavicular, or even the sacro-iliac joints, areas that are seldom if ever involved in rheumatism, the absence of lactic acid sweats, the therapeutic action of the salicylates, which have no effect upon gonorrheal arthritis, and the greater tendency to recur. The detection of the gonococcus in the joint effusion and the discovery of the original source of the infection confirm the diagnosis. Gonorrheal arthritis may be differentiated from tubercular joint lesions by the history of the case, the presence of the primary lesion, the polyarticular character of the disease, especially in its early stages, the acuteness of symptoms, the more rapid onset, the greater severity of the pain, the absence of epiphyseal involvement, and the presence of gonococci in the joint effusion. Tubercular joint lesions are not infrequently secondary to tuberculosis in other parts of the body. In doubtful cases the serum tests may be of value. In tuberculosis the *x*-ray will disclose the osseous nature of the disease. It is unusual for gonorrhea to produce true bone lesions.

**Prognosis.**—The prognosis as to life is good, but as to complete functional cure it should be guarded. In the acute form suppuration and partial destruction of the joint are frequent, whereas in the chronic type ankylosis from partial destruction of the synovial membrane and the formation of granulation tissue, in which fibrinous organization ultimately results, is common. The cases in which the effusion is serous and is limited to the intra-articular structures, and which receive prompt treatment, are those in which a complete functional cure is most likely to be secured. So long as any swelling remains relapses may occur. Recurrences are frequent. It seems probable that in some cases the gonococcus may lie dormant in the joint even after apparent cure. Cole<sup>1</sup> reports the history of an interesting case of this kind in which no subjective symptoms were present for a month, but upon the death of the patient from an intercurrent disease gonococci were recovered from the joint fluid. The history of a previous attack of gonorrheal arthritis should make the prognosis more guarded so far as complete recovery is concerned. Ankylosis is somewhat less likely to occur in children than in adults.

Some writers assert that gonorrheal arthritis is responsible for a

<sup>1</sup> Cole, R. L.: *Osler's Modern Medicine*, Philadelphia, 1907, vol. iii, p. 100.

definite proportion of the cases of arthritis deformans. This assertion has not yet been definitely proved. In McCrae's<sup>1</sup> series of 110 cases of arthritis deformans only 14, or about 13 per cent., gave a history of having had gonorrhea. As early as 1876 Bradford<sup>2</sup> described a case of ankylosis of the vertebræ—the so-called spondylitis deformans—which occurred in a patient who had suffered from repeated attacks of gonorrheal arthritis. Heiligenthal<sup>3</sup> refers to cases the histories of which have been reported by Raymond, Marie, Bier, and Rendu and Renault. In many of the cases the clinical picture closely resembles Pott's disease, but the condition is, however, usually more painful, especially during the acute stage. Kyphosis is often present.

**Treatment.**—This depends largely upon the stage of the disease, the character of the lesions present, and the amount of deformity. In mild acute cases immobilization, either in splints or in plaster-of-Paris, and the application of cold and of mercurial or ichthyol ointment (50 per cent.), are sufficient. Zieler<sup>4</sup> warns against too long-continued immobilization, owing to the danger of resulting ankylosis. Young<sup>5</sup> recommends aspiration if the effusion is marked, and, if necessary, early arthrotomy, believing that by such treatment the disease is checked before fibrous tissue has had time to form. Some authorities prefer aspiration and washing out of the joint with 2 per cent. phenol or mercury bichlorid 1 : 3000. Guyot<sup>6</sup> reports excellent results following the injection of the latter solution in 13 cases. To prevent the reaccumulation of the fluid the joint should be firmly compressed with a flannel bandage. Hildebrand<sup>7</sup> injects 5 per cent. tincture of iodine, and reports good results from its use. For a knee or a hip, Hildebrand injects 5 grams. This is followed by a local reaction, increased swelling, and pain, which, however, quickly subside. Good functional results are usually obtained. Care must be taken not to use too large a quantity of the solution. Early arthrotomy is indicated in all cases in which suppuration occurs in the joints. As much as possible of the diseased tissue should be removed, and the joint flushed with an antiseptic solution. Drainage should always be employed.

During the chronic stage aspiration and irrigation with a weak antiseptic solution should be resorted to if much effusion is present or if the disease is persistent. If the condition tends to recur, arthrotomy may

<sup>1</sup> McCrae: Quoted by Cole: *Osler's Modern Medicine*, 1907, vol. iii, p. 109.

<sup>2</sup> Bradford: *Boston Med. and Surg. Jour.*, 1876, vol. ci, p. 698.

<sup>3</sup> Heiligenthal: *Cent. f. d. Grenzgeb. der Med. u. Chir.*, 1900, vol. iii, p. 58.

<sup>4</sup> Zieler, R.: *Med. Klinik, Berlin*, February 11, 1912, vol. viii, No. 6.

<sup>5</sup> Young: *Johns Hopkins Hosp. Reports*, vol. ix, p. 532.

<sup>6</sup> Guyot: *Thèse de Paris*, 1906.

<sup>7</sup> Hildebrand: *Berlin. klin. Wochenschr.*, July 31, 1911.

become necessary. Strapping, compresses, massage, passive motion, electricity, and hot air are all beneficial. Bier,<sup>1</sup> Hirsch,<sup>2</sup> Treupel,<sup>3</sup> Zieler,<sup>4</sup> and Adams<sup>5</sup> strongly recommend the use of passive hyperemia. Hirsch<sup>6</sup> has reported the histories of 36 cases treated by this method, with satisfactory results. The treatment is applied by means of a rubber bandage that is wound about the limb, well above the affected joint. The bandage should be just tight enough to produce a slight increase in the edema, the extremity becoming warmer and of a slightly bluish color. The veins become somewhat prominent—the so-called “heisse Stauung,” or hot damming. In no case should the constriction be so severe as seriously to interfere with the circulation and produce coldness in the limb—the so-called “kalte Stauung,” or cold damming. If properly applied, the bandage should relieve pain and not increase it. Bier<sup>7</sup> recommends beginning with a brief treatment of about one hour, and gradually lengthening the periods until finally the compression remains on for twelve out of twenty-four hours. Zieler<sup>8</sup> recommends that the treatment be applied for even longer periods—twenty to twenty-two hours daily. During the intervals the limb should be elevated and a splint applied if much pain is present. Braendle<sup>9</sup> treated 17 cases of gonorrheal arthritis with injections of fulmagin, a substance somewhat similar to electrargol, with excellent results. Ten cubic centimeters were injected into the buttock every two or three days. The treatment was employed in conjunction with Bier’s hyperemia.

During the chronic stage Wilson<sup>10</sup> recommends the administration of the syrup of ferrous iodid in 30-drop doses three times a day, gradually increasing the dosage until 60 drops are taken. Guiteras<sup>11</sup> reports good results from the exhibition of 20-minim doses of oil of winter-green every four hours. In certain chronic cases potassium iodid seems to exert a favorable influence. In the acute cases opium or one of its derivatives may be required to relieve the pain, but should be administered guardedly, for fear of inducing the habit. In all cases the bowels and the diet should be regulated, and the original source of the infection treated, for reinfection is possible. Zieler<sup>12</sup> quotes

<sup>1</sup> Bier: *Hyperämie als Heilmittel*, fifth ed., 1907.

<sup>2</sup> Hirsch, J.: *Berlin. klin. Wochenschr.*, 1906.

<sup>3</sup> Treupel: *Münch. med. Woch.*, 1907, No. 39.

<sup>4</sup> Zieler, R.: *Med. Klinik*, Berlin, February 11, 1912, vol. viii, No. 6.

<sup>5</sup> Adams, E.: *Amer. Jour. Dermat.*, 1908, vol. xii, p. 6.

<sup>6</sup> Hirsch: *Loc. cit.*

<sup>7</sup> Bier: *Hyperämie als Heilmittel*, fifth ed., 1907.

<sup>8</sup> Zieler: *Med. Klinik*, Berlin, February 11, 1912, vol. viii, No. 6.

<sup>9</sup> Braendle, E.: *Med. Klinik*, 1912.

<sup>10</sup> Wilson, J. C.: *Penn. Med. Jour.*, September, 1900.

<sup>11</sup> Guiteras, R.: *New York Med. Jour.*, March 24, 1904.

<sup>12</sup> Zieler, R.: *Med. Klinik*, Berlin, February 11, 1912, vol. viii, No. 6.



Picker, who had a case of gonorrheal arthritis that persisted for three years, owing to an unrecognized reinfection. Caution should always be observed to avoid anything likely to induce exacerbations. With the subsidence of the symptoms the patient should be warned of the danger of recurrence, and prophylactic measures instituted.

#### GONORRHEAL TENOSYNOVITIS

The pathology of this condition is practically the same as that seen in other acute infections. It may arise at any time during the course of a gonorrhea, but occurs most frequently during the chronic stage. Usually only one or two tendons are involved simultaneously. The condition not infrequently occurs in conjunction with arthritis. The inflammation may be acute, subacute, or chronic. Pain, swelling, and edema around the affected tendon-sheaths are among the early symptoms. The loss of function and the inflammatory changes occurring in a young, apparently healthy individual are suggestive of this type of infection. The history of gonorrhea, and finally the detection of the specific microorganism in the effusion, confirm the diagnosis. Recurrences are frequent. As in arthritis, women are less prone to develop this complication than are men or young children. Pregnant women are more susceptible than their non-gravid sisters. Numerous cases have been recorded in which the gonococcus has been recovered in pure cultures from the effusion, the earliest of which is that of Tollemer and Macaigne,<sup>1</sup> which was followed the succeeding year by the report of Jacobi and Goodman.<sup>2</sup>

**Treatment.**—This consists of rest by means of a splint and the application of heat or cold. Belladonna and mercury ointment seems to be of value in some cases. When the symptoms are unusually severe, and the pain, heat, and swelling are marked, small, multiple incisions or punctures, made under strict aseptic precautions, give relief. Friedrich<sup>3</sup> considers this of great value. When the disease becomes chronic, massage, counterirritation, hot air, and Bier's method of hyperemia are of advantage. Passive motion, to prevent disability, adhesions, and deformities, should be practised.

#### GONORRHEAL OSTEOPERIOSTITIS

It is only rarely in gonorrheal joint lesions that the bone is attacked. According to Hirtz,<sup>4</sup> Fournier was the first definitely to establish the clinical existence of gonorrheal periosteal manifestations. He dis-

<sup>1</sup> Tollemer and Macaigne: *Rev. de Méd.*, Paris, November, 1893, p. 990.

<sup>2</sup> Jacobi and Goodman: *Beit. z. klin. Chir.*, 1894, vol. xii, p. 827.

<sup>3</sup> Friedrich: *Handb. d. praktischen Chirurgie*.

<sup>4</sup> Hirtz: *La Presse Méd.*, 1900, vol. ii, p. 407.



tinguished two forms—periostitis and periostosis, the former being an inflammatory reaction in the periosteum, and the latter a localized tumor formation. Periostitis is the more frequent, and usually attacks the tibia, the upper portion of the femur, the lower part of the humerus, and the extremities of the metacarpal or metatarsal bones. Watts<sup>1</sup> and Ducuing<sup>2</sup> emphasize the epiphyseal location of periostitis, and state that it is frequently associated with the deforming variety of gonorrheal arthritis. In Watts' case the *x*-ray showed the presence of marked thickening of the diaphysis. Durand and Nicolas<sup>3</sup> believe that only in extremely rare instances do gonorrheal lesions extend from a joint to an adjoining long bone.

**Symptoms.**—Pain is usually the most pronounced symptom, and may be gradual or sudden in onset, the former being the more frequent. The pain is generally localized to the affected area, although soreness in the muscles attached to the diseased structures is of frequent occurrence. Constitutional symptoms are, as a rule, absent, except in the acute variety, when fever and its accompanying phenomena may be present. Slight edema and redness over the affected area may be present in the early stages of the disease; later these symptoms may be entirely absent.

Gonorrheal exostosis is a rare condition. Jaeger<sup>4</sup> states that, pathologically, the process is an ossifying periostitis. The tumors vary considerably in size. The symptoms are not always proportionate to the size of the spur. Trauma seems to be a predisposing factor. Cases have been described by Jacquet,<sup>5</sup> Baer,<sup>6</sup> Ulman,<sup>7</sup> Jaeger,<sup>8</sup> Davidson,<sup>9</sup> Winthrop,<sup>10</sup> Nobl,<sup>11</sup> Davidson,<sup>12</sup> and others. About 20 cases of gonorrheal osteomyelitis have been recorded. The os calcis is the bone most frequently attacked. The disease is frequently bilateral. In some cases the only symptom is pain under the heel, which is frequently ascribed to other causes, such as flat-foot, tuberculosis, etc. At times there may be soreness in the calf muscles or over the entire plantar surface of the foot. The pain is increased by motion or pres-

<sup>1</sup> Watts, S. H.: Jour. Amer. Med. Assoc., August 19, 1911.

<sup>2</sup> Ducuing, J.: Province Med., Paris, 1911, vol. xxii, p. 122.

<sup>3</sup> Durand and Nicolas: Lyon Méd., 1907, vol. cix, p. 693.

<sup>4</sup> Jaeger: Amer. Jour. Orthop. Surg., January, 1908, vol. v, No. 3.

<sup>5</sup> Jacquet: Ann. de Dermat. et Syph., 1892, p. 681.

<sup>6</sup> Baer: Surg., Gyn., and Obst., 1906, vol. ii, p. 168.

<sup>7</sup> Ulman: Wien. med. Presse, 1900, vol. xii, p. 2225.

<sup>8</sup> Jaeger: Amer. Jour. Orthop. Surg., January, 1908.

<sup>9</sup> Davidson: Med. Record, October 3, 1908.

<sup>10</sup> Winthrop: Jour. Amer. Med. Assoc., August 28, 1909.

<sup>11</sup> Nobl: Zeit. f. Heilkunde, 1903, vol. xxiv, p. 273.

<sup>12</sup> Davidson, A. J.: Therap. Gaz., April 15, 1911, p. 243.

sure, and, as a result, the patient throws the weight forward on the ball of the foot, and while walking assumes a tip-toe gait, somewhat similar to that of a man walking on a pebbly beach in his bare feet. Pain is frequently entirely absent except when pressure is applied or the patient is on her feet. Increase in the deep leg reflexes and even ankle-clonus may be present. The condition has received various names, such as painful heel, painful foot, gonorrheal heel, and talalgia. The exostotic tumors frequently spring from the tubercle at the attachment of the flexor brevis digitorum, just in front of the point of origin of the plantar fascia. Later other osseous growths may develop. In Baer's<sup>1</sup> case the plantar surface was attacked. The diagnosis is based upon the history of the case and on the local findings. The x-ray will reveal the osseous nature of the growth. Exostoses are sometimes present at the side of and between the vertebrae, producing the symptoms of osteo-arthritis of the spine. Two such cases are described by Baer.<sup>2</sup>

That spur formation on the os calcis may be produced by causes other than the gonococcus has been amply proved. Thus Meisenbach<sup>3</sup> records 22 cases, in none of which the gonorrheal origin was proved. Indeed, this author emphasizes the rarity of the gonorrheal etiology of the condition.

**Treatment.**—The treatment of gonorrheal periostitis differs in no essential respect from that indicated for similar lesions produced by other types of infection, except that, as in all cases of metastatic gonorrhea, the condition that was the original source of the infection should receive appropriate treatment, as reinfection is possible. Palliative treatment of gonorrheal periostosis is of little avail. The outgrowths are best treated by operation, which consists of making an incision on the lateral aspect of the foot and removing the growths. Recurrence sometimes follows the removal of the tumor. During the chronic stage some cases can be relieved by properly fitted foot-plates.

#### GONORRHEAL PERICHONDritis AND CHONDritis

Gonorrheal perichondritis and chondritis are extremely rare manifestations of gonorrhea. Kimball<sup>4</sup> reports the history of a case of abscess of the larynx between the mucous membrane and the thyroid cartilage. The patient was an infant, and gonococci in pure culture were recovered from the pus of the abscess at autopsy. Finger<sup>5</sup> has

<sup>1</sup> Baer, William S.: Surg., Gyn., and Obst., 1906, vol. ii, p. 168.

<sup>2</sup> Baer, William S.: Surg., Gyn., and Obst., 1906, vol. ii, p. 168.

<sup>3</sup> Meisenbach, R. O.: Amer. Jour. Orth. Surg., February, 1912, p. 457.

<sup>4</sup> Kimball: Med. Record, 1903, vol. lxiv, p. 461.

<sup>5</sup> Finger: Quoted by Cole: *Loc. cit.*, p. 111.

recorded a case in which, during an attack of gonorrheal arthritis, tenderness and swelling developed over the thyroid cartilage. The patient recovered. Finger, Ghon and Schlagenhauser<sup>1</sup> were the first to demonstrate the gonococci in pure culture from a case of perichondritis.

## GONORRHEAL CARDIAC LESIONS

### ENDOCARDITIS

The gonococcus seems to possess a marked predilection for the endocardium, and when the heart is involved, this is the locality most frequently attacked. As early as 1847 Ricord called attention to the frequent association of endocarditis with urethritis, and since then many observers have studied the condition. Thayer and Blumer<sup>2</sup> were the first to demonstrate gonococci in pure culture in the circulating blood during life, and to recover these organisms from smears prepared from a thrombus on the heart valve at autopsy. Two years later Thayer and Lazear<sup>3</sup> recorded a similar case. The gonococcus may produce lesions in the heart in pure culture or a mixed infection may be present. That gonorrheal endocarditis is by no means infrequent is a fact now well recognized. The part played by the gonococcus in the production of endocardial lesions is, however, probably often overlooked, on account of the well-known difficulty of cultivating this microorganism on ordinary media. Norris<sup>4</sup> found this condition once in a series of 60 cases in which microorganisms were detected in vegetations or in blood from the heart.

In well-marked gonorrheal septicemia endocardial involvement may be considered the rule, rather than the exception. Dieulafoy<sup>5</sup> states that this condition occurred 27 times in a series of 34 cases of gonorrheal septicemia studied by him. The left side of the heart is more frequently affected, and the aortic valves are more often involved than the mitral. In a series of 15 cases collected by Thayer<sup>6</sup> the valves were involved in the following order of frequency, pure cultures of gonococci being obtained from each case:

Aortic.....	7	Tricuspid.....	1
Mitral.....	2	Pulmonary.....	2
Aortic and mitral.....	2		3
	<hr/> 11		

<sup>1</sup> Finger, E., Ghon, A., and Schlagenhauser, F.: *Arch. f. Dermat. u. Syph.*, Vienna and Leipzig, 1894, vol. xxviii, 3, 4 pl., p. 277.

<sup>2</sup> Thayer and Blumer: *Arch. de méd. expér. et d'anat., path.*, Paris, 1895, vol. vii, p. 701.

<sup>3</sup> Thayer and Lazear: *Med. Record*, New York, 1897, vol. lii, p. 497.

<sup>4</sup> Norris, G. W.: *Studies in Cardiac Pathology*, Philadelphia, 1911, p. 26.

<sup>5</sup> Dieulafoy, G.: *Internat. Clinics*, 1909, vol. iii, nineteenth series, p. 64.

<sup>6</sup> Thayer: Quoted by Cole: *Osler's Modern Medicine*, 1907, vol. iii, p. 97.

Thus, in 73.3 per cent. of cases the left side was affected. Both sides—all four valves—were attacked in one case. Külbs<sup>1</sup> reports the results found in 49 cases of gonorrheal endocarditis as follows:

Aortic.....	28	Aortic and mitral.....	3
Mitral.....	8	Mitral and tricuspid.....	1
Pulmonic.....	6	Aortic, mitral, and tricuspid....	1
Tricuspid.....	1	All valves.....	1

Gurvich<sup>2</sup> collected 110 cases, the records of 77 of which left little doubt as to the accuracy of the diagnosis. In this series of 77 cases the mitral valve was involved 31 times; the aortic, 16 times; and both the aortic and the mitral, 13 times. These results were based chiefly upon clinical findings. In 1898 Sears<sup>3</sup> reviewed 68 cases of gonorrheal endocarditis: in 38 cases the mitral valve was attacked, in 12 the aortic, and in 2 the pulmonic; in 8 the mitral and the aortic valves conjointly, in 1 the mitral and tricuspid, and in 1 the mitral and pulmonic. In 4 the lesion was not definitely defined. In Sear's cases, as in those of Gurvich, the diagnosis in many instances was based upon the clinical findings only.

The pathology of the mild cases is not definitely known. In the cases that have come to autopsy, ulcerative and proliferating changes have been observed. Deep and extensive ulcerations and enormous polypoid formations are not unusual, as in the case recorded by Marini.<sup>4</sup> Occasionally myocardial abscesses are observed, as in the case reported by v. Leyden.<sup>5</sup> Perforation of a valve occasionally occurs, just as in similar pathologic conditions produced by other organisms; visceral infarcts are not infrequent, but do not by any means always result in establishing new foci of infection.

Like other forms of gonorrheal septicemia, gonorrheal endocarditis occurs more frequently in men than in women. Women are more susceptible during pregnancy and the puerperium than at other times. McDonald<sup>6</sup> and Harris and Dabney<sup>7</sup> have reported instances of this condition occurring during the puerperium. Young adults are most often attacked, although the aged are by no means exempt. Not infrequently children are victims of this condition. Külbs,<sup>8</sup> in the series of 49 cases previously referred to, found that 38 cases occurred in

<sup>1</sup> Külbs: Wien. klin. Wochenschr., 1907, vol. xx, p. 11.

<sup>2</sup> Gurvich: Russk. Arch. Patol. Klin. Med. i. Bakt., 1897, vol. iii, p. 329.

<sup>3</sup> Sears: Boston City Hosp. Reports, 1898, vol. ix, p. 201.

<sup>4</sup> Marini, G.: Il Morgagni, 1909, vol. li, p. 17.

<sup>5</sup> v. Leyden: Deut. med. Wochenschr., 1893, p. 909.

<sup>6</sup> McDonald: Annals of Surgery, February, 1907.

<sup>7</sup> Harris and Dabney: Bull. Johns Hopkins Hosp., 1901, vol. xii, p. 68.

<sup>8</sup> Külbs: Wien. klin. Wochenschr., 1907, vol. xx, p. 11.

men, 12 in women, and 1 in a female child. Of Sears<sup>1</sup> cases, 61 were men and 7 were women.

The etiology is similar to that of gonorrheal septicemia. Indeed, this, like other secondary forms of gonorrhea, should be viewed as a local manifestation of a general infection.

**Symptoms.**—These differ in no essential from those produced by other forms of endocarditis. In some cases the manifestations are mild, whereas in others grave symptoms, indicative of a severe pyogenic infection, such as chills, sweats, intermittent or remittent fever, marked leukocytosis, rapidly progressive anemia, and loss of strength and flesh, are observed. Septic embolic infarcts may develop, and arthritis is a frequent complication. Gurvich,<sup>2</sup> in a series of 110 collected cases, found arthritis the most frequent complication. Arthritis was present in 48 of the 68 cases reviewed by Sears.<sup>3</sup>

In not a few cases the joint affection precedes the cardiac symptoms. Pericarditis, peritonitis, pleurisy, and other systemic manifestations of the infection may occur.

**Diagnosis.**—This depends upon the finding of the gonococcus in the heart lesion. The occurrence of pyrexia in a patient the incumbent of an uncured gonorrhea should in all cases lead to an examination of the heart. The presence of an arthritis is also a significant symptom.

**Prognosis.**—In mild cases this is guardedly favorable. In severe cases the prognosis is extremely grave. Recurrences are not infrequent.

**Treatment.**—The treatment should be largely symptomatic. The patient should be put to bed and cold applied to the precordium. The diet should be restricted, the bowels regulated, and the measures usually adopted for the treatment of endocarditis instituted.

#### PERICARDITIS

The pericardium is less frequently attacked than the endocardium, although Tyree<sup>4</sup> found this condition present in 40 per cent. of a series of fatal cases. From this it will be seen that its association with endocarditis is not uncommon. Councilman<sup>5</sup> has recorded the history of a case of pericarditis in which myocardial involvement occurred. The quantity of fluid present may be either large or small. Cole<sup>6</sup> relates the history of a case in which 800 c.c. of exudate was seen. Serous, hemorrhagic, and purulent fluid may be observed. Quite a

<sup>1</sup> Sears: *Loc. cit.*

<sup>2</sup> Gurvich: *Russk. Arch. Patol. Klin. Med. i. Bakt.*, 1897, vol. iii, p. 329.

<sup>3</sup> Sears: *Boston City Hosp. Reports*, 1898, vol. ix, p. 201.

<sup>4</sup> Tyree: Quoted by Cole: *Osler's Modern Medicine*, 1907, vol. iii.

<sup>5</sup> Councilman: *Amer. Jour. Med. Sci.*, 1903, n. s., vol. evi, p. 277.

<sup>6</sup> Cole: *Osler's Modern Medicine*, 1907, vol. iii.

number of cases of gonorrheal pericarditis have been reported in the literature during the last ten years. Hoffman<sup>1</sup> records a series of these cases.

#### MYOCARDITIS

Myocarditis alone is a rare manifestation of gonorrhea, but is frequently present to a greater or less extent as an accompaniment of endocarditis. Marini<sup>2</sup> reports the history of a case of gonorrheal septicemia in which the microorganisms were cultivated from the myocardium, as well as from the vegetations on the heart-valves and on other organs. Councilman<sup>3</sup> has recorded in detail the history of a case of gonorrheal myocarditis.

#### GONORRHEAL AORITIS

Koster<sup>4</sup> cites a case of this rare condition that occurred in a youth seventeen years of age, who, after a virulent attack of gonorrhea complicated by an arthritis and endocarditis, finally developed nephritis, pericarditis, and thrombi in the veins of both arms and died. At autopsy an aortic aneurysm was discovered. The aorta was inflamed, and clots adherent to the wall of this vessel were found to contain gonococci.

#### PHLEBITIS

Phlebitis is an extremely rare complication of gonorrhea. Zesas<sup>5</sup> has reported the history of a case which occurred during the chronic stage of the genital lesion, and developed after the patient had taken a long walk. The attack was acute and pain was a marked feature. The saphenous vein was the vessel involved. The case was treated by elevation of the limb and immobilization, and the symptoms gradually subsided.

Phlebitis is rare in women, 87 per cent. of the recorded cases having occurred in males, and, as in the case referred to by Zesas, it often follows prolonged physical exertion. The condition most frequently attacks the veins of the lower extremity, but may affect those of the pelvis or other parts of the body. The inflammation of the veins may occur during either the acute or the chronic stage of the primary infection, but it is more frequent during the former. In mild cases the attack may be ushered in by malaise and slight fever, but in the more severe forms hyperpyrexia and other evidences of a general infection

<sup>1</sup> Hoffman: *Cent. d. Grenzgeb. d. Med. u. Chir.*, 1903, p. 312.

<sup>2</sup> Marini, G.: *Il Morgagni*, 1909, vol. li, p. 17.

<sup>3</sup> Councilman: *Amer. Jour. Med. Sci.*, 1903, n. s., vol. cvi, p. 277.

<sup>4</sup> Koster, H.: *Hygiea*, vol. lxxii, Göteborg's Läkarsällskaps Förhandlingar, p. 27.

<sup>5</sup> Zesas: *Arch. gén. de chir.*, Paris, July 25, 1909, No. 7.



are present, and are often associated with arthritis or endocarditis. Tenderness along the course of the affected vein usually persists for some time after the disappearance of the swelling, and, as a result, there may be impairment of function. The disease usually runs its course in from four to six weeks, but in obstinate cases it may persist much longer.

The prognosis is, as a rule, favorable. Recurrences are not infrequent, and may occur with each fresh gonorrheal infection. Pulmonary embolism rarely results. Heller<sup>1</sup> has collected 25 cases from the literature, and has added one of his own; 16 of these cases recovered completely. Heller's case occurred in a man who suffered from an acute anterior and posterior urethritis, cystitis, and prostatitis. When the symptoms of these lesions subsided and a cure had apparently been effected, pain appeared in the calf of the left leg; this soon subsided, and three days later an indurated area 3 x 4 cm. could be made out. The skin and underlying muscle were involved. Heller at first believed this to be a gonorrheal myositis. In a few days an elongated swelling appeared in the right groin, accompanied by acute pain. The left foot was swollen, edematous, and a hard cord could be felt extending from the groin along the course of the external saphenous vein. Heller believes that there was also a phlebitis of the pampiniform plexus. In one case mentioned by Heller, gangrene, which required amputation of the limb, occurred.

Smith<sup>2</sup> has recorded a case of unusual severity that occurred during the puerperium, and in which the temperature on several occasions reached as high as 107° F. Recovery occurred after eighty-three days. Ghon and Schlagenhauser<sup>3</sup> have recorded the history of a case in which gangrene of the foot and leg, due to an embolism in the femoral artery, occurred. The condition was secondary to a severe endocardial lesion.

In the majority of the recorded cases conclusive evidence of the gonococcal origin of the disease is lacking. Arthritis was present in 16 of the cases in Heller's series and in a number of those recorded by Zesas.<sup>4</sup> The latter author states that if relapses occur in the primary lesion or a fresh infection is acquired, recurrence is likely to take place in the vein previously attacked.

**Treatment.**—This does not differ from the treatment instituted for ordinary cases of phlebitis. Complete rest and elevation and immo-

<sup>1</sup> Heller: Berlin. klin. Woch., 1904, vol. xxiii, p. 609.

<sup>2</sup> Smith, J. I.: Cleveland Med. Jour., October, 1911, p. 810.

<sup>3</sup> Ghon, A., and Schlagenhauser, F.: Wien. klin. Wochenschr., 1898, vol. xi, p. 380.

<sup>4</sup> Zesas: *Loc. cit.*



bilization of the affected part by means of splints and bandages are indicated.

#### THROMBOSIS

Thrombosis the result of gonococcal infection is seldom met with, except in cases of frank septicemia, and even under such circumstances it is by no means frequent. In cases of thrombophlebitis, as previously stated, the internal saphenous vein is the area most frequently attacked. Cases of pulmonary emboli have been recorded, but are extremely rare. Gonococcal thrombosis usually presents symptoms and pathologic changes similar to those produced by other organisms. As a rule, they are only moderately severe, although the course is often chronic. Bender<sup>1</sup> has recently reported the history of an unusual case in which a thrombus occurred in conjunction with an abscess of Bartholin's gland.

<sup>1</sup> Bender: Soc. d'Obst. et de Gyn. de Paris, April 22, 1912; also *La Gynécologie*, June, 1912, p. 361.

## CHAPTER XIX

### GONORRHEAL SKIN LESIONS.—GONORRHEA OF THE LUNGS, PLEURA, KIDNEY, AND NERVOUS SYSTEM.—PAROTIDITIS. —OTITIS.—SUPPURATIVE MYOSITIS AND SUB- CUTANEOUS ABSCESS.—WOUND INFECTION

#### GONORRHEAL SKIN LESIONS

IN 1872 Pedoux, in an address before the Société Médical des Hôpitaux, mentioned cutaneous lesions that were caused by gonorrhea. This is, perhaps, the earliest reference to this form of the disease. Gonorrhea of the skin, although a rare affection, is probably more frequent than is generally supposed, as the gonorrheal etiology is often overlooked. In 1909 Fiessinger<sup>1</sup> was able to collect 16 cases from the literature. The histories of cases have been related by Vidal,<sup>2</sup> Jeanselme,<sup>3</sup> Jacquet and Ghika,<sup>4</sup> Chauffard,<sup>5</sup> Robert,<sup>6</sup> Launois,<sup>7</sup> Stanislawsky,<sup>8</sup> Malherbe,<sup>9</sup> Baermann,<sup>10</sup> Roth,<sup>11</sup> Chauffard and Froin,<sup>12</sup> De Damany,<sup>13</sup> Hamm,<sup>14</sup> Wright,<sup>15</sup> Chauffard and Fiessinger,<sup>16</sup> Rivet and Bricout,<sup>17</sup> Rosenthal,<sup>18</sup> Sequeira,<sup>19</sup> Williams,<sup>20</sup> Chauffard,<sup>21</sup>

<sup>1</sup> Fiessinger, N.: Jour. des praticiens, September 25, 1909.

<sup>2</sup> Vidal, E.: Annales de dermatologie et de syphilographie, 1893, p. 3.

<sup>3</sup> Jeanselme, E.: Ann. de dermat. et syph., Paris, 1895, 3. S., vol. vi, p. 525.

<sup>4</sup> Jacquet and Ghika: Soc. Méd. des hôp. de Paris, January 22, 1897.

<sup>5</sup> Chauffard, A.: Soc. Méd. des hôp. de Paris, April 23, 1897; also *Ikonographia Dermatologica*, 1910, vol. v.

<sup>6</sup> Robert, E.: Thèse de Paris, April 28, 1897.

<sup>7</sup> Launois, P. E.: Soc. Méd. des hôp. de Paris, July 21, 1899, p. 736.

<sup>8</sup> Stanislawsky: Monatsb. über die Gesamtleistungen auf dem Gebiete der Erkrankungen des Harn- und Sexualapparates, 1900, p. 643.

<sup>9</sup> Malherbe: Gaz. méd. de Nantes, 1901, No. 6.

<sup>10</sup> Baermann, G.: Arch. f. Dermat. u. Syph., 1904, vol. lxi, p. 363, 1 pl.

<sup>11</sup> Roth, V.: Münch. med. Woch., May 30, 1905, p. 104.

<sup>12</sup> Chauffard, A., and Froin: Archives de Méd. expér. et d'anatomie pathologique, September, 1906, No. 5.

<sup>13</sup> De Damany: Presse Méd., 1897, No. 50, p. 282.

<sup>14</sup> Hamm, A.: Beitr. z. Geb. u. Gyn., 1908, vol. xiii, No. 2.

<sup>15</sup> Wright: Jour. Amer. Med. Assoc., July 19, 1909, p. 1996.

<sup>16</sup> Chauffard, A., and Fiessinger, N.: Bull. de la Soc. de Dermat. et Syph., May, 1909, No. 5, p. 162.

<sup>17</sup> Rivet, L., and Bricout, C.: Bulletin Médical, Paris, 1909, vol. xxiii, p. 851.

<sup>18</sup> Rosenthal: Arch. f. Dermat. u. Syph., March, 1910, p. 105.

<sup>19</sup> Sequeira, J. II.: Brit. Jour. Dermat., 1910, vol. xxii, p. 139.

<sup>20</sup> Williams, A. W.: Brit. Jour. Dermat., 1910, vol. xxii, p. 369.

<sup>21</sup> Chauffard, A.: *Ikonographia Dermatologica*, 1910, vol. v.

Jacquet,<sup>1</sup> Robin and Fiessinger,<sup>2</sup> Rost-Kiel,<sup>3</sup> Pugh<sup>4</sup> (8 cases), Simpson,<sup>5</sup> Rost,<sup>6</sup> Orłipski,<sup>7</sup> Hodara,<sup>8</sup> Heerfordt,<sup>9</sup> Arning and Meyer-Delius,<sup>10</sup> Roark,<sup>11</sup> Hodara, Osman, Izzet, and Chevket,<sup>12</sup> Haslund,<sup>13</sup> Gougerot and Saint-Marc,<sup>14</sup> and Swift.<sup>15</sup>

It is true that in the majority of these cases gonococci have not been demonstrated in the cutaneous lesions. That this organism can be the cause of a skin eruption there is little doubt. Baermann<sup>16</sup> and Heerfordt<sup>17</sup> have directed attention to the fact that the eruption frequently waxes and wanes with the infection, an exact opposite to what occurs in arthritis. It may be that in some instances the gonococci are present in the lesions only for a short time during the acute stage, and disappear quickly, or, what appears more likely, that these conditions are often toxic in origin. In considering the latter theory it must, however, be borne in mind that the gonococcus is frequently difficult to demonstrate in lesions known to be produced by it, and that, under certain circumstances, death and destruction of the microorganisms occur. From the biology of the gonococcus it would not appear that the skin, subject as it is to frequent changes of temperature and invested chiefly by squamous epithelium, would be a favorable habitat for this organism. It is also possible that certain of the skin lesions are the result of a mixed infection. As predisposing causes toward a gonorrheal skin eruption Chauffard and Fiessinger<sup>18</sup> suggest confinement to bed and restricted motion, profuse perspiration, with, perhaps, infrequent ablutions, and the wearing of rubber stockings or the prolonged appli-

<sup>1</sup> Jacquet, L.: Bull. et Mém. Soc. Méd. d. hôp. d. Paris, 1911, vol. xxxi, p. 233.

<sup>2</sup> Robin, A., and Fiessinger, N.: Bull. de la Soc. Française de Dermat. et de Syph., March, 1911, vol. xxii, p. 97.

<sup>3</sup> Rost-Kiel, G.: Zeitschr. f. Urol., 1910, vol. iv.

<sup>4</sup> Pugh, W. S.: The Military Surgeon, June, 1912, p. 686.

<sup>5</sup> Simpson, F. E.: Jour. Amer. Med. Assoc., August 24, 1912, p. 607.

<sup>6</sup> Rost: Dermat. Zeitschr., 1911, vol. xviii, p. 233.

<sup>7</sup> Orłipski: Münch. med. Woch., 1902, No. 40.

<sup>8</sup> Hodara, M.: Dermat. Wochenschr., April 6, 1912, vol. lv, p. 397.

<sup>9</sup> Heerfordt: Graefe's Arch. f. Ophth., vol. lxxvii, No. 1; also Arch. f. Dermat. u. Syph., May, 1911, p. 361.

<sup>10</sup> Arning, E., and Meyer-Delius: Arch. f. Dermat. u. Syph., Vienna and Leipzig, 1911, vol. cviii, p. 3.

<sup>11</sup> Roark, B. H.: Jour. Amer. Med. Assoc., November 23, 1912, p. 2039.

<sup>12</sup> Hodara, Osman, Izzet, and Chevket: Gaz. Méd. d'Orient., June, 1911, p. 143.

<sup>13</sup> Haslund, O.: Ugeskrift f. Laeger, Copenhagen, February 13, 1913.

<sup>14</sup> Gougerot and Saint-Marc: Ann. des mal. vén., 1912, No. 1, p. 818.

<sup>15</sup> Swift, H.: Austral Med. Gaz., November 23, 1912.

<sup>16</sup> Baermann, G.: Arch. f. Dermat. u. Syph., 1904, vol. xix, p. 363.

<sup>17</sup> Heerfordt: Graefe's Arch. f. Ophthal., vol. lxxvii, No. 1; also Arch. f. Dermat. u. Syph., May, 1911, p. 361.

<sup>18</sup> Chauffard and Fiessinger: Bull. de la Soc. Fran. de Dermat. et de Syph., May, 1909, p. 162; also Ikonographia Dermatologica, 1910.

cation of a Bier's band. These factors certainly favor the maceration of the epidermis and the accumulation of scales. These authors performed an interesting series of experiments. They found that when the skin was abraded and a serum obtained from beneath a keratotic crust rubbed in, and the area covered with a watch-crystal, they were able to reproduce the eruption in a keratotic patient. Similar lesions were not caused, however, in healthy subjects.

Skin lesions may be produced by gonococci in pure culture or in combination with other microorganisms. Gonorrheal lesions of the skin must be regarded, in the large majority of cases, as local manifestations of a general infection, and, in fact, it is only rarely that this condition is not associated with other systemic affections, such as arthritis, tenosynovitis, or endocarditis. Skin lesions are most frequent in severe gonorrheal infections. Many of the recorded cases have been in patients suffering from frank gonorrheal septicemia or pyemia. The cutaneous manifestations may occur at any time during the course of the initial lesion, but are probably more frequent during the second month of the disease, and are more common during second or subsequent attacks than during the initial infection. Like other systemic manifestations of gonorrhea, skin lesions are more frequent in men than in women, and during childhood, pregnancy, and the puerperium, than in non-gravid females.

Buschke<sup>1</sup> has exhaustively studied gonorrhea of the skin, and divides the lesions into four varieties:

**Simple Erythema.**—This is usually manifested by small, red, papular elevations, which frequently occur on the trunk, arms, or thighs, and in some cases closely resemble the rose spots of typhoid. This eruption often occurs during the course of a gonorrheal septicemia, and has been noted by Dieulafoy,<sup>2</sup> Thayer and Silvestrini,<sup>3</sup> Irons,<sup>4</sup> Pugh,<sup>5</sup> and others. A moderate degree of erythema is not infrequent about the external genitalia of women suffering from gonorrhea of the lower genital tract. It is probably caused by the toxins in the discharge.

**Urticaria or Erythema Nodosum.**—The lesions consist of firm, rounded or oval, deeply infiltrated nodes, which occur in the subcutaneous tissue and often resemble the ordinary variety of erythema nodosa. Arthritis, endocarditis, or other manifestations of a gonorrheal septicemia are usually present.

<sup>1</sup> Buschke, A.: *Arch. f. Dermat. u. Syph.*, Vienna and Leipzig, 1899, vol. xlviii, p. 181.

<sup>2</sup> Dieulafoy, G.: *Internat. Clinics*, 1909, vol. iii, nineteenth series, p. 64.

<sup>3</sup> Thayer and Silvestrini: Quoted by Dieulafoy: *Internat. Clinics*, 1909, vol. iii, nineteenth series.

<sup>4</sup> Irons: *Abst. Amer. Jour. Urol.*, 1910, vol. vi, p. 264.

<sup>5</sup> Pugh: *The Military Surgeon*, June, 1912, p. 686.

**Bullous or Hemorrhagic Eruption.**—These lesions are of rare occurrence, and are probably embolic in origin. They are usually present only in severe cases of septicemia. Paulsen<sup>1</sup> records the history of a case of this variety occurring in a child. The eruption was chiefly on the face and on the inner side of the thighs. Gonococci were demonstrated in smear preparations.

**Hyperkeratosis.**—*Kératodermie blennorrhagique* was first described by Vidal<sup>2</sup> in 1893. In 1904 Baermann<sup>3</sup> reported the history of a case of this rare condition. In all recorded cases of this variety of gonorrheal skin lesions complications, such as arthritis or endocarditis, have occurred. The eruption occurs on the plantar surfaces of the feet, on the palms of the hands, or about the nails, and occasionally on other parts of the extremities or trunk. It is often bilateral. Many of the French writers believe that the pathology of this condition is due to a trophoneurosis; in this Buschke<sup>4</sup> does not concur. He does not believe that the condition is a true keratosis, but suggests the term "*dermatitis papillaris parakeratotica*." Chauffard and Fiessinger<sup>5</sup> have also abandoned the trophic theory of the eruption. De Damany<sup>6</sup> suggests the term "*hyperkeratosis dermopapillitis*."

The pathology of a case of this condition is described by Turnball<sup>7</sup> as follows: The node is covered by a thick, horny capsule. The inter-papillary processes beneath this are much lengthened. The papillæ are very edematous and much infiltrated. In the subjacent derma there is no edema, but a little infiltration, especially around the vessels. The infiltration in the derma consists of lymphocytes with a large number of mononuclear and binuclear plasma-cells (Unna-Pappenheim stain). There are a few neutrophile polymorphonuclear leukocytes in the upper part of the papillæ and many in the capillaries. Only one or two eosinophiles were found. No mast-cells are seen. In the epidermis, the lower part of the Malpighian layer shows clear, prickly borders; karyokinetic figures are present in the basal layer. Varying numbers of neutrophile leukocytes are seen in these layers. A stratum granulosum is recognizable only in places. At this level there are very large numbers of neutrophile polymorphonuclear leukocytes in masses, occupying rounded spaces formed by the degeneration of epithelial cells. The

<sup>1</sup> Paulsen: Münch. med. Woch., 1900, vol. xlvii, p. 1209.

<sup>2</sup> Vidal: Soc. de Dermatologie, January 12, 1893.

<sup>3</sup> Baermann: Arch. f. Dermat. u. Syph., 1904, vol. lxix, p. 363.

<sup>4</sup> Buschke, A.: Arch. f. Dermat. u. Syph., Vienna and Leipzig, 1899, vol. xlviii, p. 181.

<sup>5</sup> Chauffard and Fiessinger: Bull. de la Soc. Fran. de Dermat. et Syph., May, 1909, p. 162; also *Ikonographia Dermatologia*, 1910.

<sup>6</sup> De Damany: La Presse Méd., 1897, No. 50, p. 282.

<sup>7</sup> Sequeira, J. H., and Turnball: Brit. Jour. Dermat., 1910, vol. xii, p. 139.

superficial horny layers contain many flattened nuclei and collections of neutrophile leukocytes lying in strands between the horny layers. A superficial layer of horny substance without nuclei is present in part of some of the sections. Herzog,<sup>1</sup> Chauffard and Fiessinger,<sup>2</sup> Chauffard and Froin,<sup>3</sup> Chauffard,<sup>4</sup> and Baermann<sup>5</sup> have also described this condition.

Macroscopically, the eruption appears in the form of hard masses, studded with transparent conic tips. The lesions may appear as horns or conic projections, or as large, irregular, indurated patches composed of hornified epidermis. It is generally symmetric, both hands or both feet being involved. Gonorrheal keratoid eruptions are not necessarily confined to the palms of the hands or the soles of the feet, but are generally found in these localities. The masses are usually circular, dome-like elevations, the bases of which are at first reddened. Later the base becomes more or less devoid of reaction. The eruption usually lasts for from one to three months, when the plaques drop off, leaving a dark, dirty, reddish-brown macule. If the upper part of the cone is prematurely detached, a moist, red, non-bleeding area will be found. On the under surface of the peeled mass is a slimy, grayish-white, putty-like material, composed of softened horny cells. Desquamation of the diffuse keratosis occurs simultaneously with the dropping off of plaques.

The eruption may be diffuse or confluent, and if arthritis is present, is frequently more severe on the extremity attacked by the articular inflammation. In the cases described by Roark,<sup>6</sup> Simpson,<sup>7</sup> and Arning and Meyer-Delius<sup>8</sup> lesions were present that resembled the pustules of small-pox. No scars are left by the eruption.

The disease usually has a moderately rapid onset. The subjective symptoms do not differ from those produced by hyperkeratosis of the ordinary variety. Not infrequently grave debility and cachexia are present, but these result from the general infection and not from the skin lesions. The condition is chronic, and in some of the cases recorded by De Damany<sup>9</sup> recurrences occurred with fresh attacks of

<sup>1</sup> Herzog, M.: Jour. Amer. Med. Assoc., August 12, 1912.

<sup>2</sup> Chauffard and Fiessinger: Bull. de la Soc. Fran. de Dermat. et Syph., May, 1909, p. 162; also *Ikonographia Dermatologia*, 1910.

<sup>3</sup> Chauffard and Froin: Arch. de méd. expér. et d'anat. path., September, 1906, No. 3.

<sup>4</sup> Chauffard: Soc. méd. hôp. de Paris, April 23, 1897.

<sup>5</sup> Baermann: Arch. f. Dermat. u. Syph., 1904, vol. lxxix, p. 363.

<sup>6</sup> Roark, B. H.: Jour. Amer. Med. Assoc., November 23, 1912.

<sup>7</sup> Simpson, F. E.: Jour. Amer. Med. Assoc., August 24, 1912.

<sup>8</sup> Arning, E., and Meyer-Delius: Arch. f. Dermat. u. Syph., Vienna and Leipzig, 1911, vol. cviii, p. 3, 3 pl.

<sup>9</sup> De Damany: La Presse Méd., 1897, No. 50, p. 282.



FIG. 38.—KÉRATODERMIE BLENNORRHAGIQUE.  
Cross-section showing thickening of squamous epithelium and inflammatory exudate.  
(Case of Dr. F. E. Simpson.)





gonorrhea. In a case reported by Jacquet and Ghika<sup>1</sup> the patient had six attacks of gonorrhea. In the first there was urethritis only; in the second and third, urethritis and arthritis; in the fourth, fifth, and sixth, urethritis, arthritis, and keratoderma. Fiessinger<sup>2</sup> considers maceration of the skin by retained sweat to be a predisposing cause of the condition. An excellent résumé of the literature pertaining to this rare condition may be found in Simpson's<sup>3</sup> paper, together with abstracts of cases reported by the following authors: Vidal,<sup>4</sup> Jeanseime,<sup>5</sup> Jacquet and Ghika,<sup>6</sup> Chauffard,<sup>7</sup> Robert<sup>8</sup> (2 cases), Launois,<sup>9</sup> Stanislawsky,<sup>10</sup> Malherbe,<sup>11</sup> Baermann<sup>12</sup> (2 cases), Roth,<sup>13</sup> Chauffard and Froin<sup>14</sup> (2 cases), Chauffard and Fiessinger<sup>15</sup> (2 cases), Rivet and Bricout,<sup>16</sup> Williams,<sup>17</sup> Little and Douglas,<sup>18</sup> and Simpson.<sup>19</sup> Of these 21 cases, gonorrheal arthritis was present in all but 2. Other manifestations of a general infection were present in nearly all the cases. Ophthalmia, iritis, cachexia, fever, or general weakness was observed in many. The majority of the patients were in the prime of life. In one of Robert's<sup>20</sup> cases the patient was a child four years of age. This is the youngest recorded instance of this condition. In 14 of the cases the eruption was more or less symmetric. Four of the patients had suffered from previous attacks of the disease.

The number of attacks of gonorrhea does not seem to be of great importance, as in some of the cases the eruption appeared during the first attack, whereas in others it appeared in the second, third, or fourth attack. The lesions varied from a few millimeters to 3 or 4 cm.

<sup>1</sup> Jacquet and Ghika: *Bull. et Mém. Soc. Méd. des Hôp. de Paris*, January 22, 1897.

<sup>2</sup> Fiessinger, N.: *Bull. de la Soc. Fran. de Dermat. et de Syph.*, March, 1911, vol. xxii, p. 97.

<sup>3</sup> Simpson, F. E.: *Jour. Amer. Med. Assoc.*, August 24, 1912.

<sup>4</sup> Vidal, E.: *Ann. de Dermat. et de Syph.*, 1893, p. 3.

<sup>5</sup> Jeanseime: *Ann. de dermat. et syph.*, Paris, 1895, 3 S., vol. vi, p. 525.

<sup>6</sup> Jacquet and Ghika: *Bull. et Mém. Soc. Méd. des Hôp. de Paris*, January 22, 1897, p. 93.

<sup>7</sup> Chauffard: *Ibid.*, April 23, 1897.

<sup>8</sup> Robert: *Thèse de Paris*, April 28, 1897.

<sup>9</sup> Launois, P. E.: *Soc. méd. des hôp. de Paris*, July 21, 1899, p. 736.

<sup>10</sup> Stanislawsky: "Ueber einen Fall von gonorrhöischer Urethritis mit Affektion der Gelenke, symmetrischem, hornartigen Ausschlag, und Ausfallen der Nägel," *Monatsbericht über die Gesamtleistungen a. d. Gebiete der Erkrankungen des Harn- und Sexualapparates*, 1900, p. 643.

<sup>11</sup> Malherbe: *Gaz. méd. de Nantes*, 1901, No. 6.

<sup>12</sup> Baermann: *Arch. f. Dermat. u. Syph.*, 1904, vol. lxix, p. 363.

<sup>13</sup> Roth, V.: *Münch. med. Woch.*, May 30, 1905, p. 104.

<sup>14</sup> Chauffard and Froin: *Arch. de méd. expér. et d'anat. path.*, September, 1906, No. 3.

<sup>15</sup> Chauffard, A., and Fiessinger, N.: *Bull. de la Soc. Fran. de Dermat. et Syph.*, May, 1909, No. 5, p. 162; also *Ikongraphia Dermatologica*, 1910.

<sup>16</sup> Rivet and Bricout: *Bull. méd.*, 1909, vol. xxiii, p. 851.

<sup>17</sup> Williams, A. W.: *Proc. Roy. Soc. Med.*, London, 1911, vol. iv, part 1, p. 12; also *Brit. Jour. Dermat.*, 1910, vol. xxii, pp. 361 and 363.

<sup>18</sup> Little, E. G. G., and Douglas, S. R.: *Ibid.*, 1911, vol. v, part 1, p. 8.

<sup>19</sup> Simpson, F. E.: *Jour. Amer. Med. Assoc.*, August 24, 1912.

<sup>20</sup> Robert: *Thèse de Paris*, April 28, 1897.

or more in diameter. Thickening of the skin on the palms of the hands and soles of the feet was present in many. The nails in many cases were also thickened.

Hodara<sup>1</sup> has reported the history of an interesting case of eruption due to gonococcemia. The cutaneous manifestation appeared as a livid eruption, somewhat resembling erythema multiforme, upon the thorax, abdomen, and face, with a few spots on the extremities. Within a day or two the eruption became generalized, and several large vesicles developed, containing sanguinopurulent fluid. Later the eruption increased and the contents of the vesicles became fetid. Meanwhile the temperature varied from 100° to 103° F. By the eleventh day the acute appearance of the eruption had disappeared, and desquamation had begun. Gonococci were cultivated from the blood. Histologically, the skin lesions presented the picture of a suppurative inflammation of the papillary body and epidermis.

Grosz<sup>2</sup> has reported a case of gonorrheal folliculitis and perifolliculitis. A case of folliculitis has also been recorded by Wright.<sup>3</sup> Chornaguboffna<sup>4</sup> has also studied this condition. An urticaria-like eruption, attributed to gonorrhea, has been described by Orłipski,<sup>5</sup> and Balzer and Lacour<sup>6</sup> have reported a case of purpura probably due to gonorrhea.

**Ulcers.**—Gonorrheal ulcers occurring in the skin are of unusual occurrence. Mestschersky<sup>7</sup> reports the history of a case of multiple serpiginous ulcers that were due to gonorrhea. The lesions occurred in the external genitalia, and were of a severe chronic grade. The condition was caused by a mixed infection, staphylococci and gonococci being present. An interesting feature of this case was that the gonococci were demonstrable only after the application of a strong solution of protargol. Mestschersky believes that the ulcers were the result of a lymphatic infection. The neighboring lymphatic glands were also involved. Rendu and Halle<sup>8</sup> relate the history of a case in which gonococci in pure culture were demonstrated in the endometrium removed by curetage and from a chronic ulcer at the elbow. Gonorrheal endocarditis and other evidences of a septicemia were present. Horwitz

<sup>1</sup> Hodara, H.: *Dermat. Woch.*, April 6, 1912.

<sup>2</sup> Grosz, S.: *Handb. d. Geschlechtskr.*, Leipzig u. Vienna, 1910, vol. i, p. 684.

<sup>3</sup> Wright: Abstract in *Progressive Medicine*, September, 1911, the reference to which is erroneous.

<sup>4</sup> Chornaguboffna: *Russk. J. Kazhn. i Ven. Boliezn. Mosk.*, 1911, vol. xxii, 1 pl.

<sup>5</sup> Orłipski: *Münch. med. Woch.*, October 7, 1902.

<sup>6</sup> Balzer and Lecour: *Annal. de Dermatologie*, August, 1894.

<sup>7</sup> Mestschersky, G.: *Annal. des maladies vénériennes*, December, 1910, vol. v, No. 12.

<sup>8</sup> Rendu and Halle: *Bull. et Mém. Soc. Méd. de Hôp. de Paris*, 1897, vol. xiv, p. 1325.



FIG. 39.—GONORRHEAL KERATOSIS.  
Case of Dr. B. H. Roark, Spokane, Wash.)



FIG. 40.—KÉRATODERMIE BLENNORRHIQUE.  
Case of Dr. F. E. Simpson.



and Lang<sup>1</sup> found the gonococcus in an ulcer situated upon the back of the hand.

**Diagnosis.**—The diagnosis of gonorrhea of the skin depends upon the demonstration of the specific microorganism in the cutaneous lesion. Especial care must be exercised to exclude all drug rashes that may result from treatment of a simple genital gonorrhea. The lesions must also be differentiated from the various syphilids. Cutaneous lesions occurring during the course of a gonorrheal septicemia or in conjunction with a gonorrheal arthritis are strongly suggestive of this type of infection.

Paulsen<sup>2</sup> has called attention to the fact that various cutaneous lesions may result from inoculation by the gonococcus during birth, and has described several such cases in infants.

**Treatment.**—This naturally varies according to the stage and severity of the pathologic condition present. Simple erythemata are, as a rule, transient and do not require treatment. In the more severe lesions cleanliness and the application of antiseptics, especially the silver salts, are of benefit. The x-ray, which has been employed with advantage in the treatment of ordinary venereal warts, has been suggested for the treatment of the keratoid variety of gonorrhea of the skin, which, from a histologic basis, is somewhat similar to condylomata acuminata. Constitutional treatment is indicated if a septicemia is present. Tonics and improved hygiene are necessary in debilitated patients.

### GONORRHEA OF THE LUNGS

During the course of a gonorrheal septicemia the lungs are sometimes attacked. Dieulafoy<sup>3</sup> records the history of a case, the lesion being a double bronchopneumonia, which for a week placed the patient's life in danger. Bressel,<sup>4</sup> Thayer and Lazear,<sup>5</sup> and Wynn<sup>6</sup> also record cases of this condition. Thayer and Blumer<sup>7</sup> relate the history of a case in which there were several patches of bronchopneumonia with hemorrhagic infarcts. The symptoms of gonorrheal pneumonia do not differ materially from those produced by similar lesions caused by other microorganisms. The prognosis is grave. A positive diagnosis can be made only by demonstrating the gonococcus

<sup>1</sup> Horwitz and Lang: *Wien. klin. Woch.*, 1893, vol. vi, p. 59.

<sup>2</sup> Paulsen: *Münch. med. Woch.*, June 18, 1901.

<sup>3</sup> Dieulafoy, G.: *Internat. Clinics*, vol. iii, nineteenth series, p. 59.

<sup>4</sup> Bressel: *Münch. med. Woch.*, 1903, vol. i, p. 563.

<sup>5</sup> Thayer and Lazear: *Jour. Exper. Med.*, 1899, p. 81.

<sup>6</sup> Wynn, W. H.: *Lancet*, London, 1905, vol. i, p. 352.

<sup>7</sup> Thayer and Blumer: Quoted by Dieulafoy: *Internat. Clinics*, vol. iii, nineteenth series, p. 59.

by means of cultures taken from the sputum, or from the affected areas after death, as it is necessary to exclude the *Micrococcus catarrhalis*, which, morphologically and tinctorially, is a similar microorganism whose habitat is in the mouth, although it may also be found throughout the respiratory tract.

#### GONORRHEAL PLEURISY

The pleura may be attacked either in conjunction with a pneumonia or independently. Septicemia is invariably present. To Mazza<sup>1</sup> is due the credit for having been the first to demonstrate gonococci in pure culture from a pleural effusion. Thayer and Lazear<sup>2</sup> recorded a case in which 800 grams of fluid were found in the right pleural cavity and 550 grams in the left. The liquid was rich in gonococci. Gonorrheal pleurisy is frequently bilateral. The amount of fluid varies in different cases. As in all cases of gonorrheal septicemia, children and pregnant women are more susceptible than are non-gravid females. Men are more frequently attacked than women. Two cases recorded by Cardile occurred in young girls. Both were mild and recovery took place. The convalescence was, however, prolonged. Arthritis is a frequent complication, and may precede, accompany, or follow the condition. No characteristic symptoms other than those usually produced by an ordinary pleurisy have been described. Bertrand<sup>3</sup> states that gonorrheal pleurisy may be either dry or accompanied by an effusion. Most of the reported cases have been of the latter variety.

The presence of gonococci in the genital tract, the symptoms of septicemia, an arthritis, and, lastly, the demonstration of the gonococcus in the circulating blood all point to this type of infection. The prognosis should be extremely guarded in all cases, for while the pleurisy may in itself be of a mild grade, the general infection that accompanies these cases may at any time produce fatal complications. The diagnosis depends upon the demonstration of the gonococcus in the pleural effusion. It is necessary to exclude other morphologically similar microorganisms. Mixed infections may occur. The following is a summary of authentic cases of gonorrheal pleurisy that have occurred in the literature. They have been obtained chiefly from the works of Faure-Beaulieu<sup>4</sup> and Geraud and Johnston-Lavis<sup>5</sup>:

*Bardoni and Uffreduzzi.*<sup>6</sup>—The symptoms were those of an ordinary pleurisy. The case was complicated by an arthritis.

<sup>1</sup> Mazza: *Gior. d. R. Accad. di Med. di Torino*, 1894, p. 180.

<sup>2</sup> Thayer and Lazear: *Jour. Exper. Med.*, 1899, p. 81.

<sup>3</sup> Bertrand: *Thèse de Paris*, March, 1896, No. 188.

<sup>4</sup> Faure-Beaulieu: *Thèse de Paris*, 1906.

<sup>5</sup> Geraud, H., and Johnston-Lavis, H. J.: *Proceed. Roy. Soc. Med. Clin. Sec.*, June, 1912, p. 217.

<sup>6</sup> Bardoni and Uffreduzzi: *Deut. med. Woch.*, 1894, vol. xx, p. 484.



*Bartholow*<sup>1</sup> reports a case of septicemia, during the course of which a pleurisy developed. Bacteriologic proof of gonococcal origin of the pleurisy is lacking. Arthritis and conjunctivitis were present, and the specific organism was recovered from the urethra.

*Bertrand*.<sup>2</sup>—The disease occurred on the right side, and was accompanied by fever and rapid pulse. Gonococci were demonstrated in the pleural effusion by their morphology and staining reaction; the organism did not grow on ordinary media.

*Cardile*.<sup>3</sup>—The patient was a female, twenty-three years of age. Infection six weeks prior to development of pleurisy. Rigors, fever, pains in right side of chest, and cough were the most prominent manifestations. Aspiration was performed two weeks after the onset of the foregoing symptoms. Recovery occurred after two and a half months. Gonococci were demonstrated in the pleural effusion by both culture and staining methods.

*Chiaiso and Isnardi*.<sup>4</sup>—Patient was a girl of ten years of age, a victim of rape. One month after infection fever, cough, pain in the chest, and objective symptoms of a pleurisy of the right side developed. Aspiration was performed twice, and recovery occurred in one month. The first aspiration was negative for gonococci, but the second showed these organisms present in the pleural effusion.

*Crosby*.<sup>5</sup>—Male, thirty-one years of age. Duration of genital gonorrhea, three weeks. Symptoms, partial delirium, fever, high pulse, rapid respirations,—42,—general septic appearance, and signs of pleural effusion. Purulent stomatitis, ophthalmia, nephritis, and rhinitis were present. Patient died shortly after admission to hospital. Autopsy showed that right pleural cavity contained 400 c.c. of thin purulent fluid, whereas the left contained 1000 c.c. of similar material. The lungs were also involved, the condition being not so much a pneumonia as a formation of local areas of suppuration. Gonococci were demonstrated in the pleural effusion and in the pus from the eyes, nose, mouth, ethmoid cells, trachea, pelvis of the kidney, bladder, urethra, and lungs. Staphylococci were also present in the latter organs. The gonococci were recognized by their morphology and staining properties.

*Dieulafoy*<sup>6</sup> quotes Scherrer as having reported the history of a case of gonorrheal pleurisy. The author has been unable to trace this reference.

*Fisher*<sup>7</sup> reports a case of pleurisy of gonorrheal origin in a man twenty-six years of age. Aspiration was performed twice. No gonococci were found in the fluid obtained by the first puncture, but in that from the second gonococci were demonstrated by their morphology and staining characteristics.

*Geraud and Johnston-Lavis*.<sup>8</sup>—Male, aged nineteen. Three months after infection the patient was seized with violent pains in the back; the temperature and pulse soon rose, the fever became hectic, and profuse sweats occurred. Temporary anuria developed. With the onset of the fever the urethral symptoms subsided. Symptoms of pleurisy soon appeared. The case was treated by incisions and drainage. The clinical course was prolonged, but a cure was finally effected. The fluid removed from the pleural effusion was clear, yellowish, and contained numerous floating clots of yellowish, glue-like mucus and pseudomembrane. Later, considerable pus developed. The fluid first removed contained a pure culture of gonococci. A peculiar feature of this case was that there was manifest concordance between the respiratory and pulse-rates; these rates almost always went down when the temperature rose. Diagnosis, gonorrheal empyema.

*Jicinsky*.<sup>9</sup>—Male, aged twenty-four. Sudden sharp pain in the region of the nipple, soon followed by cough, copious expectoration, sweats, fever, rapid pulse, dyspnea, and other evidence of pleurisy. The clinical duration of the case was eight weeks. Gonococci were found in the pleural effusion by culture and staining methods.

*Krause*.<sup>10</sup>—This was a case of double pleurisy, in which gonococci were present in the exudate.

<sup>1</sup> Bartholow, P.: Amer. Jour. Dermat. and Gen.-Urin. Dis., April, 1912, p. 169.

<sup>2</sup> Bertrand: Thèse de Paris, 1906.

<sup>3</sup> Cardile: Clin. Med. Ital., Milan, 1899, vol. xxxviii, p. 549.

<sup>4</sup> Chiaiso and Isnardi: Giorn. d. R. Accad. med. di Torino, February, 1894.

<sup>5</sup> Crosby, D.: Amer. Jour. Med. Sci., 1905, vol. cxxix, p. 880.

<sup>6</sup> Dieulafoy: Internat. Clinics, vol. iii, nineteenth series, p. 59.

<sup>7</sup> Fisher, A.: Ces. Lekarske Listy, 1898.

<sup>8</sup> Geraud and Johnston-Lavis: Loc. cit.

<sup>9</sup> Jicinsky, J. R.: Jour. Amer. Med. Assoc., February 4, 1899, p. 231.

<sup>10</sup> Krause: Berlin. klin. Woch., 1904, vol. xl, p. 492.

*Mazza*.<sup>1</sup>—The patient was a girl who became infected as a result of rape. The chief symptoms were malaise, fever, pains in the left shoulder and other articulations. Signs of pleurisy slowly developed, and eight weeks later aspiration was performed. Gonococci were demonstrated in the pleural effusion. The outcome of the case is not stated.

*Paldrock*.<sup>2</sup>—This paper merely states that Sanarelli cultivated gonococci derived from a pleural exudate of a girl aged eleven years.

*Prochaska*.<sup>3</sup>—The patient was a male, aged thirty-seven, and a dyer by trade. Gonorrhea was contracted about a year prior to the development of a septicemia. Gonococci in pure culture were recovered from the blood. One month later symptoms of pleurisy became manifest. Aspiration was followed by gradual recovery. Gonococci were demonstrated in the pleural effusion.

*Smith*.<sup>4</sup>—Female, aged twenty-one years. General gonorrheal septicemia following labor. Death two months later. Bilateral pleurisy. Gonococci recovered from pericardial and pleural effusions, from aortic valves, lung, Fallopian tubes, and endometrium. Gonococci identified by staining methods only.

*Thayer and Lazear*.<sup>5</sup>—The patient was a male. The pleurisy was double. The right cavity contained 800 grams of fluid; the left, 550. The liquid was rich in gonococci which were demonstrated by culture and staining.

### GONORRHEA OF THE KIDNEY

If those cases that are associated with frank, well-defined clinical septicemia are excluded, gonorrhea of the kidney is a rare condition. In 1911 Nixon,<sup>6</sup> in an excellent paper, reported the histories of 2 cases and was able to collect 10 additional instances of this condition from the literature. Many other cases have been recorded as being gonococcal in origin, and in many of these the diagnosis has, in all probability, been correct, but absolute confirmatory evidence, founded upon bacteriologic proof, is lacking. The gonococcus may produce lesions in the kidney either in pure culture or in combination with other microorganisms. Six of the 12 cases studied by Nixon were cases of mixed infections, and in 6 the gonococcus alone was present. Wagner<sup>7</sup> reviewed 19 cases collected from the literature, in some of which an absolute bacteriologic diagnosis was lacking. Of these 19 cases, 10 were mixed infections and 9 were probably purely gonococcal in type. Sellei and Unterberg<sup>8</sup> record the histories of 5 cases, 4 of which were mixed infections. Knorr<sup>9</sup> states that mixed infections are the most frequent. The staphylococcus, the streptococcus, the *Bacillus coli*, the tubercle bacillus, the typhoid bacillus, and other microorganisms have been found in kidney lesions in conjunction with the gonococcus.

<sup>1</sup> Mazza: *Giorn. d. R. Accad. di Med. di Torino*, 1894, p. 180.

<sup>2</sup> Paldrock: *Der Gonokokken Neisseri. Eine literärische und bakteriologische experimentelle Studie*, Dorpat, 1907, p. 91.

<sup>3</sup> Prochaska: *Deut. Arch. klin. Med.*, Leipzig, 1905, vol. lxxxiii, p. 184.

<sup>4</sup> Smith, J. T.: *Cleveland Med. Jour.*, October, 1911, p. 810.

<sup>5</sup> Thayer and Lazear: *Jour. Exper. Med.*, 1899, p. 81.

<sup>6</sup> Nixon, P. I.: *Surg., Gyn., and Obst.*, April, 1911, p. 331.

<sup>7</sup> Wagner, F. R.: *Med. Rec.*, New York, October 1, 1910, p. 568.

<sup>8</sup> Sellei and Unterberg: *Berlin. klin. Woch.*, 1907, vol. xlv, p. 1113.

<sup>9</sup> Knorr, R.: *Zeit. f. gynäk. Urologie*, February, 1910, vol. ii, No. 1.

There is some doubt as yet that a suppurating lesion of the kidney can be produced by the gonococcus alone, and many authorities believe that a mixed infection is present in all such cases. In mixed infections the question of priority is of interest, and many authors believe that the gonococcus not infrequently prepares the soil for the tubercle bacillus, or perhaps some other variety of microorganism. That this rôle is played by the gonococcus in pelvic lesions is now recognized, and Kolischer<sup>1</sup> and others have drawn attention to its importance. In one of Nixon's cases it appeared that a tuberculous infection was superimposed on a gonorrheal lesion. In Nixon's<sup>2</sup> series the right kidney was involved 8 times; the left, 3 times, and both kidneys, twice. Men are more frequently attacked than women, and non-pregnant women are less susceptible than are children, gravid females, or women during the puerperium. Pyelitis, pyelonephritis, and pyonephritis have been described; the first of these is the most frequent in those cases in which gonococci alone were present.

**Modes of Infection.**—The gonococcus may reach the kidney by way of the general circulation, as the result of a septicemia, or it may result from an ascending infection. In men the infection seems to be conveyed most frequently by way of the circulatory system, whereas among women ascending infections appear to predominate, but the number of recorded cases from which to draw accurate conclusions regarding this point is as yet small.

**Hematogenous Infection.**—The existence of a gonorrheal septicemia has been amply proved. Howell<sup>3</sup> and other physiologists have shown that, of the total quantity of blood that passes through the heart in one minute, 5 or 6 per cent. is forced through the kidney in a like interval of time. In view of this fact it would seem that renal lesions should be more frequent in cases of septicemia than they are. Thus, in Cole's<sup>4</sup> series of 29 cases of general gonococcal infection, none showed any active involvement of the kidney. It has, however, been amply proved by Dudgeon,<sup>5</sup> Geraghty,<sup>6</sup> and others that pathogenic microorganisms may pass through the kidney without producing severe lesions. In frank septicemias embolic renal abscesses are, however, not infrequent.

**Ascending Infections.**—Certain conditions seem to favor an ascending infection; among these are menstruation, pregnancy, labor.

<sup>1</sup> Kolischer, G.: Surg., Gyn., and Obst., April, 1911, p. 341.

<sup>2</sup> Nixon: Surg., Gyn., and Obst., April, 1911, p. 331.

<sup>3</sup> Howell, W. H.: Text-book of Physiology, 1905, p. 749.

<sup>4</sup> Cole: Osler's Modern Medicine, 1908, vol. iii, pp. 88-120.

<sup>5</sup> Dudgeon: Lancet, 1908, vol. i, p. 615.

<sup>6</sup> Geraghty: Trans. Amer. Assoc. Gen.-Urin. Surg., 1909, vol. iv, p. 263.

irritation either from a calculus or from a preëxisting disease, such as tuberculosis or syphilis, anemia, or other conditions that diminish the tonicity of the tissues of the ureter or prevent the free downward flow of the urine. Lewis<sup>1</sup> reports the history of an interesting case in which three ureters were present, only one of which was attacked. This author believes that anomalies of the ureter favor an ascending infection. Cystitis or trigonitis of gonorrheal origin is by no means uncommon. That ascending infections are not more frequent can be accounted for only by the fact that the vesical openings of the ureters are normally tightly closed by a sphincteric action except during the escape of urine, and that the downward flow of the fluid washes away infection and tends to prevent an extension of the inflammation upward. The epithelium of the ureter is not of the type usually attacked by the gonococcus.

Sampson<sup>2</sup> has shown that, in the case of ordinary microorganisms, obstruction to the ureter is a strong predisposing factor to infection of the kidney. This observer experimented on dogs, tied the ureters, and injected 2 c.c. of a twenty-four-hour culture of *Staphylococcus aureus* into the jugular vein, and in every instance the kidney whose ureter had been ligated became infected. It would seem, therefore, that a stricture of the ureters would also act as a predisposing factor in a gonorrheal infection of the hematogenous variety. Dowd<sup>3</sup> and others assert that an ascending infection may occur without bladder involvement. In the case of the gonococcus, an organism that, in the genital tract, at least travels by continuity, it appears more probable that ascending infections are usually caused by a direct surface extension upward from the trigone. Cases in which gonorrhea of the kidney has been recorded without gross vesical involvement, and that were ascending infections, can probably be accounted for by the fact that the cystitis may have disappeared by the time the renal symptoms became manifest, or that a low-grade trigonitis may have been present and been overlooked on cystoscopic examination. Other routes of ascending infection are, however, possible. Sampson,<sup>4</sup> by methods of injection, has demonstrated the existence of the vesico-utero-ovario-renal circulation; also that infection may pass through the blood-vessels of the ureter, and that there is free communication between the arteriovenous circulation of the bladder and the ureter throughout the length of the latter. The possibility of an

<sup>1</sup> Lewis, B.: *Jour. Cutan. and Gen.-Urin. Dis.*, September, 1900, p. 395.

<sup>2</sup> Sampson, J. A.: *Johns Hopkins Hosp. Bull.*, 1903, vol. xiv, p. 334.

<sup>3</sup> Dowd, J. H.: *Med. Rec.*, New York, 1898, vol. liii, p. 939.

<sup>4</sup> Sampson: *Johns Hopkins Hosp. Bull.*, 1903, vol. xiv, p. 334.

ascending infection traveling along the lymphatics must also be considered. In some types of infection this is probably the most important route. Stewart<sup>1</sup> and Kumita<sup>2</sup> have shown that there is a close connection between the lymphatics of the ureter and those of the perinephritic tissue. Uysing<sup>3</sup> and others have demonstrated the presence of gonococci in the lymphatics and lymph-stream. This route of infection is, however, probably rare in the case of gonorrhea.

**Symptoms.**—The number of recorded cases from which to draw accurate conclusions are as yet too few. Thus, the period between the onset of the infection in the genitalia and the appearance of renal symptoms is quite variable, and no rule for this can be laid down. In Weisswange's<sup>4</sup> case the symptoms appeared during the puerperium, six years after the original infection. Conversely, Marcuse<sup>5</sup> records the history of a case in which the renal symptoms appeared ten days after the onset of urethritis. In both the hematogenous and the ascending infection it would seem that renal involvement would be more likely to occur during the chronic than during the acute stage of the original infection, as both septicemia and cystitis are more prone to occur at this time. The symptoms of renal involvement do not differ markedly from those produced by similar lesions resulting from other microorganisms. The onset is, as a rule, gradual, although in cases supposed to be gonorrheal in type, the histories of which have been reported by Ravogli,<sup>6</sup> the appearance of the renal symptoms was sudden and acute. Backache—pain in the region of the kidney, sometimes radiating to the groins—is often present. If the case is one of an ascending infection, the symptoms of either an antecedent or a concomitant cystitis can nearly always be elicited. In this variety pain or tenderness along the course of the ureter is frequent. In the hematogenous variety the symptoms of a septicemia, with not infrequently an arthritis or other metastatic manifestations, are generally present. Fever, with its accompanying phenomena, is often observed, but varies with the stage of the disease and the acuteness of the infection. Gastric disturbances, such as nausea, vomiting, loss of appetite, and coated tongue, may occur. Either diarrhea or constipation may be present, but the former is the more common condition. As the disease advances anemia, loss of strength and weight, and more or less prostration may result, or the patients may be well nourished. The urine

<sup>1</sup> Stewart, L. F.: University of Pennsylvania Med. Bull., 1910, vol. xxiii, p. 233.

<sup>2</sup> Kumita: Arch. f. Anat. u. Entwicklungsgesch., Leipzig, 1909, p. 49.

<sup>3</sup> Uysing: Inaug. Dissert., Kiel, 1900.

<sup>4</sup> Weisswange: Münch. med. Wochenschr., 1908, vol. iv, p. 967.

<sup>5</sup> Marcuse, B.: Monats. f. Urologie, Berlin, 1902, vol. vii, p. 127.

<sup>6</sup> Ravogli: Amer. Jour. Urology, New York, 1906, vol. iii, No. 14, p. 551.

contains albumin, renal epithelium, casts, blood, pus, and gonococci, the latter are often demonstrable in the casts and in the renal epithelium. The urinary findings naturally vary with the stage of the disease and the variety of lesion present. At first the amount of urine is diminished, but later polyuria often exists. Some writers lay great stress upon the diagnostic significance of large quantities of albumin in the urine in these cases. The actual value of the finding of albuminuria in formulating the diagnosis of the condition is still undetermined, but is probably not great. Of far greater value in the determination of the condition of the kidney is the x-ray, combined with ureteral catheterization and the injection of collargol or argyrol. Renal abscesses can be frequently detected by this method, and the urine for bacteriologic examination can be obtained directly from the kidney. In certain suspected cases ureteral catheterization is not justifiable on account of the danger of spreading the infection. The presence of gonococci within the tube-casts is very suggestive.

**Diagnosis.**—This depends upon the demonstration of the gonococci in the kidney—either in the urine in the kidney, in the pus in the kidney, or in the renal tissue. No other evidence is acceptable.

**Prognosis.**—This should be guarded, but depends largely upon the individual case, as the pathology may vary from a moderate degree of inflammation to large single or multiple abscesses. In cases of general infection the prognosis is less favorable than when the condition has resulted from an ascending infection. Tuberculosis may be secondary to gonorrhea of the kidney. Gonorrheal renal lesions are sometimes extremely chronic. In one of Lewis'<sup>1</sup> cases it had possibly existed for twelve years, and during that period the patient had pus in the urine and other symptoms referable to the kidney; in this case an interstitial nephritis and numerous abscess cavities were present that, from their appearance, had apparently existed for a long time. On the other hand, one of Asahara's<sup>2</sup> cases was characterized by fulminating symptoms. The patient, a girl of sixteen, was brought to the Moabit Hospital, in Berlin, unconscious. A diagnosis of sepsis, appendicitis, and peritonitis was made. An autopsy revealed gonococci in the pus of a renal abscess and in the lungs. The case was one of gonococcal septicemia.

**Treatment.**—This depends upon the lesions present, the stage of the disease, and the condition of the individual patient. In general, the treatment is that usually employed for similar lesions produced by other microorganisms. During the early stage of the disease, and when

<sup>1</sup> Lewis, B.: *Jour. Cutan. and Gen.-urin. Dis.*, September, 1900, p. 395.

<sup>2</sup> Asahara: "Über Metastasen den Gonorrhöe," *Inaug. Dissert.*, Berlin, 1898.



the kidney pelvis approaches the normal, lavage with silver salts is indicated. This treatment is often successful. If the disease is extensive and much destruction of renal tissue has taken place, nephrectomy or nephrotomy offers the best hope of cure. Constitutional treatment, similar to that usually employed for nephritis, should be instituted. During the acute stage the diet should consist largely or entirely of milk; alkaline drinks are sometimes beneficial. Urinary antiseptics, such as salol or urotropin, may be prescribed. If the condition is the result of an ascending infection, the cystitis or trigonitis must be treated, whereas in all cases the primary focus should if possible be eradicated. In the chronic cases tonics and efforts to improve the general hygiene should be employed. The following authentic cases of pyelitis, in which the gonococcus alone was present, have been recorded:

*Dodge.*<sup>1</sup>—Female, who three weeks after marriage developed a cystitis. Later, pain and tenderness in the region of the left kidney developed. The catheterization of the left ureter showed a cloudy, pus-laden renal urine, from which undoubted gonococci were demonstrated. The kidney was irrigated with boric-acid solution, followed by the instillation of a dram of 25 per cent. argyrol solution. The symptoms disappeared at once and no gonococci were demonstrable after the third treatment.

*Hagner.*<sup>2</sup>—Male, aged thirty-five years. Patient had contracted gonorrhea twice—the first attack ten years, and the second five or six weeks, before renal symptoms developed. The first symptoms consisted of pain and tenderness along the course of the right ureter and in the inguinal region, with slight elevation of temperature. A urethritis and prostatitis cleared up under treatment, but pyuria persisted. The cystoscope revealed a trigonitis, and catheterization of the right ureter withdrew pus-laden urine from which undoubted gonococci were demonstrated. The use of argyrol and the x-ray showed the renal pelvis to be of normal size. Treatment consisted of lavage with a 1 per cent. solution of silver nitrate and the injection of vaccines. A cure resulted.

*Lehr.*<sup>3</sup>—Male, aged twenty-seven, seen November 6, 1911, complaining of a urethral discharge and dysuria. Patient had two previous attacks of gonorrhea, from which he recovered promptly. The present attack began October 5, 1911. Examination showed a scanty purulent discharge that contained gonococci. There was marked terminal hematuria. The prostate and seminal vesicles were apparently normal. The hematuria and pain subsided in about two weeks under rest and internal medication. Local treatment was instituted, but in spite of all efforts the urine remained cloudy and continued to show gonococci until January 20th, when cystoscopic examination revealed purulent urine coming from the left ureter. This ureter was catheterized and some of the urine inoculated on serum-agar. The report from the laboratory showed a pure culture of gonococci. Stock and autogenous vaccines were tried, but without beneficial result. On February 15th pelvic lavage with silver nitrate was begun. After four of these treatments with solutions of silver nitrate, varying in strength from 1:5000 to 1:2500, the urine became clear and remained so, and cultures on serum-agar proved negative.

*Lewis.*<sup>4</sup>—Male, aged twenty-four years. Six years prior to the onset of renal symptoms the patient suffered from repeated attacks of urethritis which were resistant to treatment. Lewis suspected renal involvement. On cystoscopic examination three ureteral openings were seen. Ureteral catheterization of the right and left ureters showed clear

<sup>1</sup> Dodge, W. T.: Jour. Mich. State Med. Soc., 1905, vol. iv, p. 58.

<sup>2</sup> Hagner, F. R.: Trans. Amer. Assoc. Gen.-urin. Surg., 1910, vol. v, p. 16; also Med. Rec., New York, 1910, vol. lxxviii, p. 568.

<sup>3</sup> Lehr, L. C.: Jour. Amer. Med. Assoc., April 27, 1912, p. 1307; also Jour. Amer. Med. Assoc., July 6, 1912, p. 36.

<sup>4</sup> Lewis, B.: Med. Rec., New York, October 6, 1903, p. 521.



urine. A catheter passed into the central opening withdrew cloudy, pus-containing urine, from which gonococci were demonstrated. Lavage with silver nitrate solution effected a cure, and no further urethral symptoms developed. Lewis believes that the recurrences of the urethritis were due to the reinfection from the kidney.

*Marcuse.*<sup>1</sup>—Case 1.—Male, aged twenty-five; gave a history of urethritis twice. The first attack, two years, and the second, three months, before the onset of the renal symptoms. The chief symptom was pain in the right side, in the region of the kidney. By ureteral catheterization on the right side urine was obtained that was cloudy and contained pus and typical gonococci. After two recurrences the symptoms were finally cured by lavage. The kidney was hydronephrotic and had a capacity of 100 c.c. of fluid.

Case 2.—Male, aged twenty-two years. The onset of the renal symptoms occurred ten days after the beginning of a urethritis. The chief symptom was pain and tenderness in the renal regions. On the twentieth day after the appearance of urethritis ureteral catheterization showed cloudy, pus-laden urine from the right side, which contained numerous typical gonococci, and a clear urine from the left kidney. The case was treated by lavage with silver nitrate solution, and recovery ensued.

*Sellei and Unterberg.*<sup>2</sup>—Patient was a man who had had symptoms of urethritis, prostatitis, and cystitis for about ten months. The usual treatment resulted in some improvement. At about this time moderate pain and tenderness developed in the region of the right kidney, and pyelitis was suspected. No fever or other manifestation of a general infection was present. The cystoscope revealed a well-marked trigonitis, and the urine from the right kidney, obtained by ureteral catheterization, contained diplococci that were subsequently grown in culture-media, and that corresponded morphologically, tinctorially, and culturally to the gonococcus. The urine was cloudy and contained pus. The case was cured by lavage.

The following is the brief history of a case of gonorrhea of the kidney that occurred in the Gynecologic Department of the University of Pennsylvania:

Female, aged thirty-one. Purulent leukorrhea since marriage, six years ago. Symptoms of cystitis for the last three months. Examination shows an indurated drainage tract leading from an old suburethral abscess to a point a little above the exit of Bartholin's gland. Gonococci were recovered by smears from the urethra, cervix, Bartholin's gland, remains of old abscess, and bladder. Cystoscopic examination shows an easily permeable stricture of the urethra. The trigone was the seat of a low-grade chronic inflammation. Just below the opening of the left ureter was an ulcer 1 or 2 cm. in diameter. Clear urine was expelled from the right ureter, and pus and urine from the left. Ureteral catheterization confirmed the above, and from the urine thus obtained from the left kidney gonococci were demonstrated. The case is still in the ward, so that the result of treatment cannot as yet be stated. It would appear, from our present finding, that there is little doubt that the case is one of an ascending infection. A positive diagnosis of this variety of lesion is not yet possible.

The following are the abstract reports of cases of pyelonephritis, which, with one exception, were probably due to mixed infections:

*Franco.*<sup>3</sup>—Female, aged twenty-six. Symptoms of ureteritis and pyonephrosis on the right side for four years. Catheterization of kidney showed gonococci in pure culture. Nephro-ureterectomy was followed by a cure. Examination of the kidney showed it to have been converted into a large pyonephritic sac. Microscopically, it showed changes resembling those found in chronic parenchymatous nephritis, and numerous foci of chronic interstitial nephritis. Severe pyelitis and ureteritis were present. Franco is in doubt as to whether the condition was due to an ascending or a hematogenous infection.

*Gerster.*<sup>4</sup>—Male, ten years of age. Renal symptoms developed three weeks after the onset

<sup>1</sup> Marcuse, B.: *Monats. f. Urologie*, Berlin, 1902, vol. vii, p. 127.

<sup>2</sup> Sellei, J., and Unterberg, H.: *Berlin. klin. Woch.*, 1907, vol. xlv, p. 1113.

<sup>3</sup> Franco, E. E.: *Folio Urologica*, February, 1912, vol. vi, No. 8, p. 552.

<sup>4</sup> Gerster, A. G.: *New Yorker med. Monatsschr.*, New York, 1897, vol. ix, p. 189.

of a urethritis. The symptoms were acute. Nephrectomy, followed by autopsy, showed both kidneys involved. A number of abscesses were present in the right kidney, and a single small abscess in the left kidney; also a small abscess in the prostate. The bladder mucosa was hemorrhagic. Gonococci were demonstrated in the kidney by staining methods and cultures.

*Lewis*.<sup>1</sup>—Male, fifty-four years of age. The patient was admitted to the hospital in a semi-conscious condition. Denied having had urethritis. Had suffered for twelve years from more or less chronic symptoms referable to the kidney. The patient died, and autopsy revealed tuberculous cavities in both lungs. The right kidney was enlarged and contained a number of abscesses, from the pus of which gonococci were demonstrated by staining methods. The case may have been a mixed infection with the tubercle bacilli, as there is no record that the renal tissue was examined for these microorganisms.

*Nixon*.<sup>2</sup>—*Case 1*.—Female. Date of original infection not definitely determined, but had "considerable leukorrheal discharge lately." General health poor for four years. Pains in left side and down the thighs for four months. Frequent urination. Lost 10 pounds in weight. During the last few months patient has had what she termed "good days" and "bad days." For several days she would feel well and the urine would be clear. Then pain in the side would appear, and the urine would become cloudy and the urination frequent. Examination revealed an indefinite, firm, tender mass in the left lumbar region. Gonococci were recovered from the urethra. The urine was cloudy and contained pus. Cystoscopic examination showed the bladder normal except for slight redness about the left ureteral orifice. Ureteral catheterization showed clear urine from the right kidney and an obstruction 2 cm. up the left ureter. No tubercle bacilli in urine. At nephrotomy an abscess containing 150 c.c. of pus was evacuated, from which gonococci were grown. Two months later the patient returned, with a persistent sinus at the site of the original operation, in the discharge from which tubercle bacilli were demonstrated. Nixon states that it is impossible to determine absolutely which microorganism was the primary invader.

*Case 2*.—Negress, aged forty-eight years. Renal symptoms began thirteen years ago. Attacks of pain in the left side, which came on irregularly at first,—two or three a year,—but now occur every month or so. Pain starts in the region of the left kidney and radiates along ureter. The pain is sharp, with frequent colicky exacerbations, and is sometimes accompanied by nausea and vomiting. There is frequency of urination. Examination was negative except for a purulent leukorrhea. Temperature varied between 99° and 100° F.; pulse, 90; leukocytes numbered 74,000. Urine acid, specific gravity, 1015, contained albumin and much pus. Cystoscopic examination: bladder normal; ureteral orifices normal. Purulent urine seen escaping from the left side. Ureters catheterized and cultures of renal urine made. Six milligrams of phenolsulphophthalein given intramuscularly and urine collected for one hour.

	RIGHT KIDNEY	LEFT KIDNEY
Time of appearance of drug . . .	8 minutes . . . . .	10 minutes.
Amount of urine . . . . .	210 c.c. . . . .	125 c.c.
Amount of drug . . . . .	40 per cent. . . . .	12 per cent.
Urea per liter . . . . .	14 gm. . . . .	2 gm.
Microscopic examination . . . . .	Negative . . . . .	Many pus-cells.

Operation, nephrectomy and partial ureterectomy.

*Gross Description*.—The specimen consists of the kidney and 5 cm. of ureter. The hardened kidney measures 5 x 5 x 4.5 cm. The capsule over the lower third strips easily, whereas over the upper two-thirds it is densely adherent. The contrast between these two areas with the capsule stripped is quite marked: the lower part is yellow in color and has a smooth surface; the upper part presents a brownish, mottled appearance; its surface is rough, and shows several deep indentations; the mottled appearance is due to scattered areas of superficial hemorrhage. On section the contrast is equally well marked; at the lower pole there is an area of yellowish-gray kidney tissue, 3 x 2 cm., which is doubtless a hypertrophy, compensatory in nature; Malpighian bodies are easily seen; the cortical striae are obliterated. In the upper two-thirds there is no renal tissue left; it has been replaced by five or six abscess-cavities, which vary from 1 to 2 cm. in diameter; these cavities correspond to the indentations noticed on the surface. They are lined by rather firm granulation tissue, and all communicate with the kidney pelvis more or less directly, and into those

<sup>1</sup> Lewis, B.: Jour. Cutan. and Gen.-urin. Dis., New York, 1900, vol. xviii, p. 395.

<sup>2</sup> Nixon, P. I.: Surg., Gyn., and Obst., 1941, vol. xii, No. 4, p. 331.

nearest the pelvis the pelvic epithelium can be seen extending, some of them appearing to be almost completely lined by epithelium. The abscesses are separated by dense fibrous tissue. The pelvis is contracted and greatly thickened. The epithelium is much increased in thickness, and is here and there heaped up into white elevations above the surface, which resemble leukoplakia buccalis. There is nothing to suggest tuberculosis.

*Microscopic Description.*—The renal parenchyma shows evidence of compensatory hypertrophy; the tubules are somewhat distended; the cells are slightly flattened and have undergone parenchymatous degeneration. The greater part of the kidney is made up of scar-tissue, in which can be seen old and young fibroblasts, scattered round-cells, and round-cells collected in places, especially in the region of the pelvis, into definite lymph-nodes with germinal centers. Section of the abscess-walls shows them to be lined for the most part by granulation tissue with a loosely attached exudate; in the region of the kidney pelvis the pelvic epithelium has proliferated, so that in places a single layer of swollen cells completely encircles the cavity. The epithelium of the kidney pelvis, notably in the white patches previously mentioned, has undergone a remarkable metaplasia—a transformation from the transitional to the squamous type. The cells have increased in number, and those on the surface are flattened and have lost their nuclei. In a word, the epithelium is not dissimilar to skin epithelium. There is no evidence of acute infection, and nowhere is there anything that resembles tuberculosis. Undoubted gonococci were demonstrated in the pus from the renal abscess by cultures and staining. Typhoid bacilli were grown from the renal urine of the infected kidney. The patient had had typhoid fever twenty-five years previously.

*Weisswange.*<sup>1</sup>—Female, aged thirty-four years. Contracted gonorrhea six years before onset of renal symptoms. During puerperium developed symptoms of sepsis and pain in right renal region. The kidney was tender and enlarged. The urine contained gonococci. Under medical treatment the patient improved and was subsequently discharged from the hospital, but two months later returned with a recurrence of the renal symptoms. Nephrectomy was performed. The kidney was enlarged, and in the upper pole was a moderate-sized abscess. The remainder of the kidney appeared normal. Gonococci in the wall of the abscess were demonstrated by staining. No cultures were taken, so that the possibility of other microorganisms having been present cannot be excluded.

Cases of gonorrhea of the kidney associated with frank gonorrheal septicemia have been reported by Asahara<sup>2</sup> (2 cases, one gonococci alone and the other a mixed infection), Wynn<sup>3</sup> (mixed infection), and others.

The following authors have reported the histories of cases of gonorrhea of the kidney, in many of which a correct diagnosis undoubtedly was made, but positive bacteriologic proof, as instanced by the recovery of the gonococcus from the urine or pus in the kidney or from the kidney substance, is lacking: Bockart,<sup>4</sup> Fürbringer,<sup>5</sup> Balzer and Souplet,<sup>6</sup> Neuendorff,<sup>7</sup> Kelly,<sup>8</sup> Mendelsohn,<sup>9</sup> Schmidt,<sup>10</sup> Berg,<sup>11</sup> Cum-

<sup>1</sup> Weisswange, F.: Münch. med. Wochenschr., 1908, vol. lv, p. 967.

<sup>2</sup> Asahara: "Über Metastasen den Gonorrhöe," Inaug. Diss., Berlin, 1898.

<sup>3</sup> Wynn, W. H.: Lancet, London, 1905, vol. i, p. 352.

<sup>4</sup> Bockhart, M.: "Beiträge z. Ätiol. u. Path. des Harnröhrentrippers," Vierteljahresschr. f. Dermat. u. Syph., Vienna, 1883, vol. x, p. 3.

<sup>5</sup> Fürbringer, P.: Die innere Krankheiten der Harn- und Geschlechtsorgane, Berlin, 1890.

<sup>6</sup> Balzer and Souplet: Annal. d. dermat. et syph., Paris, 1892, vol. iii, p. 113.

<sup>7</sup> Neuendorff, F.: Inaug. Diss., Berlin, 1892.

<sup>8</sup> Kelly, H. A.: Johns Hopkins Hosp. Bull., 1895, vol. vi, p. 19.

<sup>9</sup> Mendelsohn: Berlin. klin. Woch., 1896, vol. xxxiii, p. 309.

<sup>10</sup> Schmidt: Inaug. Diss., Munich, 1897.

<sup>11</sup> Berg, H. W.: Med. Rec., New York, 1899, vol. lv, p. 602.

ston,<sup>1</sup> Young,<sup>2</sup> Cabot,<sup>3</sup> Ravogli,<sup>4</sup> Denis,<sup>5</sup> Stoyantchoff,<sup>6</sup> Küster and Wagner,<sup>7</sup> Waelsch,<sup>8</sup> Wladimirsky,<sup>9</sup> Carlslaw,<sup>10</sup> Aronstam,<sup>11</sup> Dowd,<sup>12</sup> Stojanschoff and Rosenfeld,<sup>13</sup> and Pollock and Harrison<sup>14</sup> (merely mention a case while discussing treatment). Mortz<sup>15</sup> has recently contributed a valuable paper on this subject.

#### PERINEPHRITIS

Miyata<sup>16</sup> reports the history of a case of this rare condition. The patient was a man who had a gonorrheal urethritis four years previously. The patient was suddenly seized with severe pains in the right hip and loin. The pain was accompanied by chills and a high fever. An exploratory puncture at the level of the lowest rib revealed the presence of pus, which was subsequently found to contain gonococci. An exploratory incision showed the condition to be a perinephritic abscess. Gonococci were again demonstrated, and were also found in the connective tissue. Recovery followed the operation. This locality is rarely attacked by the gonococcus; indeed, many writers assert that this organism never invades connective tissue primarily.

#### GONORRHEA OF THE NERVOUS SYSTEM

Only in rare instances does the gonococcus produce lesions in the nervous system, although paragonorrheal manifestations are more frequent. The etiology is not definitely clear. Moltchanoff,<sup>17</sup> Kienbock,<sup>18</sup> and others believe that it is due to toxins. Moltchanoff injected killed cultures of gonococci into animals. In these cases an

<sup>1</sup> Cumston, C. G.: Univ. Penn. Med. Mag., Phila., 1899, vol. xi, p. 504.

<sup>2</sup> Young, H. H.: The Gonococcus: A Report of Successful Cultivations. Contributions to the Science of Medicine, Baltimore, 1900, p. 704.

<sup>3</sup> Cabot, F.: Post. Grad., New York, 1906, vol. xxi, p. 559.

<sup>4</sup> Ravogli, A.: Amer. Jour. Urology, New York, 1906, vol. ii, p. 551.

<sup>5</sup> Denis: Jour. Méd. de Brux, 1907, vol. xii, p. 44.

<sup>6</sup> Stoyantchoff: Amer. Jour. Urology, New York, 1909, vol. v, p. 184.

<sup>7</sup> Küster and Wagner: Handbuch der Urologie, vol. ii, p. 178.

<sup>8</sup> Waelsch: Handb. d. Geschlechtsk., Leipzig and Vienna, 1910, vol. i, p. 815.

<sup>9</sup> Wladimirsky: Dermat. Zeitsch., vol. x, p. 320.

<sup>10</sup> Carlslaw: Glasgow Med. Jour., June, 1893, vol. xxxix, No. 6.

<sup>11</sup> Aronstam, N. E.: Amer. Jour. Dermat., March, 1912, p. 120.

<sup>12</sup> Dowd: Med. Rec., New York, 1898, vol. liii, p. 937.

<sup>13</sup> Stojanschoff and Rosenfeld: Berlin. klin. Woch., July 25, 1898.

<sup>14</sup> Pollock, C. E., and Harrison, L. W.: Gonococcal Infections, London, 1912, p. 177.

<sup>15</sup> Mortz, B.: Rev. clin. d'Urol., Paris, 1912, vol. i, p. 124.

<sup>16</sup> Miyata: Folia Urologie, 1910, vol. v, No. 10.

<sup>17</sup> Moltchanoff: Münch. med. Wochn., 1899, vol. xvi, p. 1013.

<sup>18</sup> Kienbock: Samml. klin. Vorträge, Leipzig, 1901, No. 315.

ascending paralysis resulted, and it was possible to demonstrate microscopic lesions in the spinal cord and peripheral nerves.

**Neuritis and Neuralgia.**—In 1888 Charcot<sup>1</sup> directed attention to this condition. Many of the cases described have been associated with articular lesions, and for this reason difficulty usually occurs in determining the exact etiology of the condition, as it is necessary to exclude the muscular atrophy and other symptoms that may result from an arthritis from those produced by the direct action of the gonococcus or its toxins upon the nerves. Eulenberg<sup>2</sup> reports the histories of 9 cases of gonorrheal neuritis, in 6 of which the sciatic was the nerve involved, 2 were of the tibial, and 1 in the radial and median. Barbellion<sup>3</sup> has also reported the history of a case of sciatica, presumably due to the gonococcus. When sciatica is present, bilateral involvement usually occurs. Lesser<sup>4</sup> believes that cases of sciatica, especially those occurring in women in whom no etiologic factor can be demonstrated, are often caused by gonorrhea. These cases are associated with gonorrhea of the genital tract, usually a urethritis. They tend to recur with subsequent attacks of gonorrhea, and the onset is generally sudden. Campbell<sup>5</sup> describes a form of toxic neuritis that frequently accompanies gonorrheal urethritis, in which single nerves or groups of nerves are affected. The condition is most commonly noted in the nerve supply of the extensors of the foot.

General gonorrheal neuritis, unassociated with articular lesions, is of extreme rarity. Kienbock<sup>6</sup> has collected 4 such cases. In 1905 Bernhart<sup>7</sup> recorded the history of a case of paralysis in the distribution of the musculocutaneous nerve, which he attributed to this type of infection. No arthritis was present. Lorat-Jacob and Salomon<sup>8</sup> relate the history of a case of lumbosacral radiculitis. No gonococci were found in the spinal fluid, although the authors believed the condition to be due to this variety of infection. Cros<sup>9</sup> has collected several cases of crural and lumbo-abdominal neuralgia which he thought due to gonorrhea. Dieulafoy has seen 2 cases of intercostal neuralgia which he believes were the result of gonorrhea. Gonorrheal myelitis

<sup>1</sup> Charcot, Jean-Martin: *Leçons du Mardi à la Salpêtrière*, July 3, 1883.

<sup>2</sup> Eulenberg: *Deut. med. Woch.*, 1900, vol. xxvi, p. 686.

<sup>3</sup> Barbellion, G.: *Jour. de méd. de Paris*, 1912, 2d S., vol. xxiv, p. 356.

<sup>4</sup> Lesser: Quoted by Cole: *Osler's Modern Medicine*, Lea Bros., Philadelphia and New York, 1907, p. 113.

<sup>5</sup> Campbell, J.: *Amer. Jour. Dermat.*, May, 1912, p. 225.

<sup>6</sup> Kienbock: *Samml. klin. Vorträge*, Leipzig, 1901, No. 315.

<sup>7</sup> Bernhart: *Berlin. klin. Woch.*, 1905, vol. xiii, p. 1097.

<sup>8</sup> Lorat-Jacob and Salomon: *Bull. de la Soc. Méd. des Hôp. de Paris*, July 4, 1907, p. 679.

<sup>9</sup> Cros: Quoted by Dieulafoy: *A Text-book of Medicine* (translation), 1910, vol. ii, p. 2001.

of the diffuse dorsolumbar type has been described. The cranial meninges and even the brain itself may be attacked by the gonococcus. This, however, very rarely occurs. Dieulafoy<sup>1</sup> states that the symptoms may be of four distinct types: delirious, maniacal, meningitic, and apoplectic. In the two last the prognosis is extremely grave. As early as 1870 Politzer<sup>2</sup> mentioned a case in which purulent conjunctivitis was followed by meningitis. Haushalter<sup>3</sup> referred to a case of microcephalus and idiocy which he ascribed to gonococci passing from an inflamed eye to the meninges and brain substance. Fürbringer<sup>4</sup> has reported the history of an interesting case: The patient, a laborer, suffered from a urethritis and more or less severe wandering pains over the entire body; he became stuporous and partially unconscious. Lumbar puncture evacuated 25 c.c. of partially purulent, turbid fluid, which contained organisms morphologically similar to the gonococcus. The case terminated fatally, and at autopsy the pia mater and spinal cord were found infiltrated with pus which contained similar microorganisms. Kienbock,<sup>5</sup> Ware,<sup>6</sup> Kankarovitch,<sup>7</sup> Glyn,<sup>8</sup> Leyden,<sup>9</sup> Sellenew,<sup>10</sup> and Christmass<sup>11</sup> have reported instances of neuritis believed to have been produced by the gonococcus or its toxins. In most cases the lesions have been multiple.

**Diagnosis.**—The demonstration of the gonococcus in lesions of the nervous system is attended by much difficulty, and many of the recorded cases are of doubtful etiology. Thus, in 1894 Barrie<sup>12</sup> collected 25 cases, in only a very few of which was the clinical diagnosis confirmed by autopsy findings. In none of these cases were gonococci cultivated from the lesions in the nervous system. Coincident neurologic conditions must be excluded.

**Neuroses.**—Neuroses are more frequent in men than in women, and usually manifest themselves during the course of a posterior urethritis; they are paragonorrheal in type. The symptoms may vary from a slight melancholia to severe mental disturbances. Among women, neuroses are more frequent during pregnancy or the puer-

<sup>1</sup> Dieulafoy: *A Text-book of Medicine*, 1910, vol. ii, p. 2001.

<sup>2</sup> Politzer: *Jahrb. f. Kinderheilk.*, 1870, p. 335.

<sup>3</sup> Haushalter: Quoted by S. Stephenson: *Ophthalmia Neonatorum*, London, 1907, p. 142.

<sup>4</sup> Fürbringer: *Deut. med. Woch.*, 1899.

<sup>5</sup> Kienbock: *Volkmann's Samml. klin. Vorträge*, No. 92.

<sup>6</sup> Ware, M. F.: *Amer. Jour. Med. Sci.*, July, 1901.

<sup>7</sup> Kankarovitch: *Vratch*, 1901, p. 1346.

<sup>8</sup> Glyn: *Lancet*, September 27, 1902.

<sup>9</sup> Leyden: *Zeit. f. klin. Med.*, 1892, vol. xxi.

<sup>10</sup> Sellenew: *Monats. f. Urologie*, 1902, No. 10, p. 590.

<sup>11</sup> Christmass: *Annal. de l'Inst. Pasteur*, vol. xi, No. 7.

<sup>12</sup> Barrie: Quoted by Cole: *Osler's Modern Medicine*, Philadelphia and New York, 1907, p. 113.



perium, and in married women than in the single. No doubt frequent local treatment and, in many, the fear of a possible operation, are contributing factors. Long-continued pain and self-reproach for an illicit intercourse are also predisposing causes. Bossi<sup>1</sup> believes that much hysteria and many neuropathic conditions and psychopathies, with their resulting suicides and crimes, are dependent upon chronic lesions of the genital organs, especially when of infectious origin. He cites many cases in which hysteria, Graves' disease, mental alienation, kleptomania, suicide, and murder have resulted in individuals in whom it was possible to demonstrate the presence of chronic genital lesions. Many of these cases recovered after a course of careful gynecologic treatment. Bossi believes that every insane woman should be carefully examined, and if gynecologic lesions are found, these should receive appropriate treatment. Bossi advocates an active propaganda among physicians and the public to teach the undoubted effect of the condition of the genital organs on the nervous and mental systems.

Ortenau<sup>2</sup> and Schultze<sup>3</sup> agree with Bossi's conclusions. Manton<sup>4</sup> doubts whether pelvic disorders ever cause insanity, but states that certain conditions, by acting as foci of irritation, tend to prolong the insane condition and add more or less to its severity. Guicciardi and Leoni<sup>5</sup> and Taussig<sup>6</sup> are of a similar opinion. The last-named author states that there are three facts that point to some sort of relationship existing between gynecologic disease and manic-depressive insanity. These are the decidedly greater frequency of gynecologic disease in the insane,—74 per cent., as compared with the average 47 per cent.,—the large proportion of chronic inflammatory conditions in the insane, and the proportionately large percentage of mental recoveries after gynecologic operations performed on women having manic-depressive insanity. Taussig<sup>7</sup> concludes that in manic-depressive insanity every patient should be subjected to a gynecologic examination, and that when a definite lesion is found, this should be corrected. Neuroses the result of gonorrhea have also been described by Orlipski.<sup>8</sup> The author believes that Bossi's views are extreme, and that great caution should be exercised before attributing insanity to pelvic inflammatory lesions. Chronic suffering of any kind is no doubt a predisposing cause in many cases.

<sup>1</sup> Bossi: *Rev. Mens. de Gyn., d'Obst., et de Pæd.*, November, 1911.

<sup>2</sup> Ortenau, G.: *Münch. med. Woch.*, October 29, 1912.

<sup>3</sup> Schultze: Quoted by Taussig, F. J.: *Jour. Amer. Med. Assoc.*, August 31, 1912, p. 713.

<sup>4</sup> Manton: *Ibid.*, p. 715. <sup>5</sup> Guicciardi and Leoni: *Annali di Ostetrica*, July, 1912.

<sup>6</sup> Taussig, F. J.: *Jour. Amer. Med. Assoc.*, August 31, 1912, p. 713.

<sup>7</sup> Taussig: *Loc. cit.*

<sup>8</sup> Orlipski: *Alleg. med. Central-Zeitung*, 1912, No. 43.



## GONORRHEAL PAROTIDITIS

Dennis<sup>1</sup> reports a case of parotiditis probably gonorrheal in origin. The patient was a woman twenty-eight years of age. Symptoms of pelvic peritonitis had been present for some time. No attempt was made to demonstrate gonococci in the genito-urinary tract. Twelve days after the appearance of an arthritis the right parotid gland became swollen and tender; a few days later the left gland also became involved. The skin over the gland was red, swollen, and shiny. Later, fluctuation could be elicited. The gland was incised and drained. The pus obtained contained numerous diplococci. No other micro-organism could be detected. These cocci were morphologically similar to the gonococcus. No cultures were made, and consequently the possibility of the infection having been due to the *Micrococcus catarhalis*, an organism morphologically and tinctorially similar to the gonococcus, and a frequent inhabitant of the mouth, cannot be excluded. Powers<sup>2</sup> records the history of a case in which the entire upper extremity on one side was involved. A little later a parotiditis developed. Gonococci and staphylococci were demonstrated in the discharge from the parotid gland, from the neck, and from the chest. The case is not described in detail, nor has it been possible to trace the reference.

## GONORRHEAL OTITIS

Reinhard<sup>3</sup> has reported the history of a case of this condition that occurred in a child. Gonorrheal vulvovaginitis was also present. The clinical symptoms of the otitis differed in no respect from those usually encountered in cases of otitis due to the ordinary pyogenic microorganism. In Reinhard's case gonococci were demonstrated by both smear and culture in the discharge. The nose and pharynx were not involved. The condition yielded readily to treatment, which consisted in irrigations with a weak antiseptic solution.

## SUPPURATIVE MYOSITIS AND SUBCUTANEOUS ABSCESS OF GONORRHEAL ORIGIN

For many years it was thought that the gonococcus could not produce suppuration in connective tissue. This was due largely to the experiments of Wertheim<sup>4</sup> and Steinschneider.<sup>5</sup> The former injected

<sup>1</sup> Dennis, W. A.: *St. Paul Med. Jour.*, 1911, vol. xiii, p. 183.

<sup>2</sup> Powers, C. A.: Quoted by Campbell, W. F.: *New York Med. Jour.*, February 22, 1908, p. 356.

<sup>3</sup> Reinhard: *Abst. in Amer. Jour. Urology*, 1908, vol. iv, p. 116.

<sup>4</sup> Wertheim: *Arch. f. Gyn.*, Berlin, 1892, vol. xlii, p. 66.

<sup>5</sup> Steinschneider: *Berlin. klin. Woch.*, 1893, p. 729.

a pure culture of gonococci into the subcutaneous tissue of two men. The only result was a moderate degree of redness and induration over the site of inoculation, which disappeared in three days. Under similar circumstances the latter authority, even when employing large amounts of pure cultures, failed to produce any reaction whatever.

In neglected or unusually severe cases of suppurative bone or joint lesions extension to the adjacent muscles is not uncommon, and has been commented upon by Decousser,<sup>1</sup> Horwitz,<sup>2</sup> Lang and Paltauf,<sup>3</sup> Jundell,<sup>4</sup> Young,<sup>5</sup> and others. Abscesses occurring in muscles in conjunction with septicemia are less frequent.

The following writers have recorded the histories of cases in which intramuscular abscesses of gonococcal origin have been present: Harris and Haskell<sup>6</sup> have recorded a case in which a suppurative process was present in the gastrocnemius and soleus muscles; Bujivid,<sup>7</sup> Bloodgood and Young,<sup>8</sup> Wynn,<sup>9</sup> Cassel,<sup>10</sup> Strong,<sup>11</sup> Kienbock,<sup>12</sup> Ware,<sup>13</sup> Lang and Paltauf.<sup>14</sup> The last two authors were the first to demonstrate gonococci in pure culture from a subcutaneous abscess, but credit is due to Bujivid<sup>15</sup> for the similar demonstration in intramuscular abscesses not associated with tendon-sheath infection. In Horwitz's<sup>16</sup> and Lang and Paltauf's<sup>17</sup> cases the abscess occurred upon the dorsum of the hand in connection with a tenosynovitis. Jundell's<sup>18</sup> case was one of a large subcutaneous abscess in the calf of the leg in connection with a tenosynovitis of the tibialis posticus muscle. The abscess appeared in the third week of the gonorrhea, and was cured by free

<sup>1</sup> Decousser: Thèse de Paris, 1905.

<sup>2</sup> Horwitz: Wien. klin. Woch., 1893, vol. vi, p. 59.

<sup>3</sup> Lang and Paltauf: Arch. f. Dermat. u. Syph., Vienna, 1903, vol. xxv, p. 330.

<sup>4</sup> Jundell: Arch. f. Dermat. u. Syph., Vienna, 1897, vol. xxxix, p. 75.

<sup>5</sup> Young, H. H.: Contributions to the Science of Medicine, Baltimore, 1900, p. 677.

<sup>6</sup> Harris and Haskell: Johns Hopkins Hospital Bull., 1904, vol. xv, p. 395.

<sup>7</sup> Bujivid: Cent. f. Bakt., 1895, vol. xviii, p. 435; also Arch. f. Dermat. u. Syph., Vienna, vol. xxxviii.

<sup>8</sup> Bloodgood and Young: Quoted by Thayer and Lazear, J. S.: Jour. Exper. Med., 1899, vol. iv, p. 95.

<sup>9</sup> Wynn: Lancet, February 11, 1905, p. 352.

<sup>10</sup> Cassel: Verein f. innere Medizin, Berlin, June 8, 1903.

<sup>11</sup> Strong: Quoted by Campbell, W. F.: New York Med. Jour., February 22, 1908, p. 356.

<sup>12</sup> Kienbock: Volkmann's Samml. klin. Vorträge, No. 92.

<sup>13</sup> Ware, M. F.: Amer. Jour. Med. Sci., July, 1901.

<sup>14</sup> Lang and Paltauf: Arch. f. Dermat. u. Syph., Vienna, 1903, vol. xxv, p. 330.

<sup>15</sup> Bujivid: Cent. f. Bakt., 1895, vol. xviii, p. 435; also Arch. f. Dermat. u. Syph., Vienna, vol. xxxviii.

<sup>16</sup> Horwitz: Wien. klin. Woch., 1893, vol. vi, p. 59.

<sup>17</sup> Lang and Paltauf: Arch. f. Dermat. u. Syph., Vienna, 1903, vol. xxv, p. 330.

<sup>18</sup> Jundell: Loc. cit., 1897, vol. xxxix, p. 175.

incisions and drainage. Bujivid<sup>1</sup> records the history of a man suffering from a urethritis in whom four abscesses appeared one week after a catheterization. One abscess was in front of the left elbow, one in the right popliteal space, one over the right external malleolus, and one on the inner side of the left leg. Bujivid believes the abscesses to have been intramuscular, but this was not positively proved. Young<sup>2</sup> reports a peri-urethral abscess, a large peritoneal abscess, a gonococcal infection of an arthrectomy wound in the knee, with superficial abscesses in the region of the incisions, a subcutaneous abscess on the dorsum of the hand, an abscess and fistula of the perineum and serotum, all occurring in men. The etiology of the lesions in all but one case was proved by smears and cultures; in one case the cultures were negative. Stephenson<sup>3</sup> records a remarkable case of gonorrheal septicemia secondary to an eye lesion in an infant, in which numerous abscesses, both subcutaneous and intramammary, were present, and from the pus of which gonococci were identified by staining methods. Abscesses the result of the gonococcus do not differ from those produced by other pyogenic microorganisms. The concomitant symptoms of septicemia are usually present. Cassel's<sup>4</sup> case occurred in an infant. One of the muscles in the back was the part attacked. Ophthalmia was also present. Gonococci in pure culture were demonstrated from both lesions. In one of Wynn's<sup>5</sup> cases the abscesses were of large size and bilateral, both calves being involved. Mixed infection is frequent.

Cases of cellulitis in areas other than the pelvis have been recorded by Hansen<sup>6</sup> and Almkvist.<sup>7</sup> In the former's case a hard, indurated swelling appeared on the sternum, which subsequently became fluctuant, and finally broke down, and from the pus of which gonococci were demonstrated. In Almkvist's case bilateral areas of cellulitis appeared on the inner side of the tarsus; these finally suppurated and gonococci were identified in the pus.

#### WOUND INFECTION BY GONOCOCCI

This is comparatively seldom encountered, but occasionally follows arthrotomy, as in the cases recorded by Meyer<sup>8</sup> and Young.<sup>9</sup>

<sup>1</sup> Bujivid: *Cent. f. Bakt.*, 1895, vol. xviii, p. 435; also *Arch. f. Dermat. u. Syph.*, Vienna, vol. xxxviii.

<sup>2</sup> Young, H. H.: *Contributions to the Science of Medicine*, Baltimore, 1900, p. 677.

<sup>3</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 143.

<sup>4</sup> Cassel: *Verein f. innere Medizin*, Berlin, June 8, 1903.

<sup>5</sup> Wynn: *Lancet*, February 11, 1905, p. 352.      <sup>6</sup> Hansen, C. T.: *Dermat. Zeit.*, 1910.

<sup>7</sup> Almkvist, J.: *Arch. f. Dermat. u. Syph.*, 1899, vol. xlix, p. 163.

<sup>8</sup> Meyer, F.: *Deut. med. Woch.*, 1903, vol. xxix.

<sup>9</sup> Young: *Johns Hopkins Hosp. Reports*, Baltimore, 1900, vol. ix, p. 677.

Baginsky<sup>1</sup> has reported the history of a case in which the umbilical cord was infected by the gonococcus. Welander<sup>2</sup> mentions 2 cases of orbital infection by the gonococcus following enucleation of the eyes. Both patients were males and were the incumbents of uncured urethral gonorrhea. Welander believes that the infection resulted from protective eye-glasses which were worn after the enucleation, and that the eye-glasses were contaminated by the patients while attempting to clean them with infected fingers.

Emery and Sabatier<sup>3</sup> report the history of a case of a nurse who accidentally ran a splinter of wood into her finger, and who, a few hours later, dressed a case of Bartholin's disease. Within twelve hours the finger began to pain, and in spite of poultices, etc., pus formed. The abscess was opened on the fifth day. Gonococci were demonstrated in the pus. The condition was strictly local and the source of the infection undoubted. Sarfert<sup>4</sup> found the gonococcus the infecting agent in a mammary abscess occurring during the puerperium.

That local wound infection is of rare occurrence is proved by the relative infrequency in which infection occurs when operating for gonorrheal lesions, or when performing plastic operations upon women known to be suffering from this disease. West<sup>5</sup> reports an interesting case of this kind in which the abdominal wound broke down after a bilateral salpingectomy for gonorrheal pus-tubes. Gonococci were recovered in the pus from the wound for some time subsequent to the operation, but disappeared after a thorough irrigation of the wound with 25 per cent. argyrol. The wound then healed rapidly and complete recovery followed. v. Leyden<sup>6</sup> found gonococci in a myocardial abscess and in vegetations on the valves. The organisms were identified by their morphology and staining properties.

<sup>1</sup> Baginsky: Quoted by Cole: *Osler's Modern Medicine*, Philadelphia and New York, 1907, p. 92.

<sup>2</sup> Welander: Quoted by Ledermann, R.: *Amer. Jour. Dermat.*, November, 1910, p. 520.

<sup>3</sup> Emery and Sabatier: *La Clinique*, November 10, 1909.

<sup>4</sup> Sarfert: *Deut. med. Woch.*, 1894, No. 8.

<sup>5</sup> West: *The Post-Graduate*, April, 1912, p. 275.

<sup>6</sup> v. Leyden: *Deut. med. Woch.*, 1893, p. 909.

## CHAPTER XX

### GONORRHEAL THERAPY

#### DRUGS EMPLOYED IN THE LOCAL TREATMENT OF GONORRHEA

THE local treatment of gonorrhea is one of the most difficult problems in modern medicine, and it is because of the unsatisfactory results often obtained that many female gonorrheics ultimately become surgical cases. In order intelligently to institute the proper local treatment of gonorrhea a thorough knowledge of the pathology of the lesions to be dealt with, the stage of the disease, and the individual peculiarities of the patient, as well as her social standing and morale, is necessary. The gonococcus is an organism peculiarly susceptible to germicides, and when encountered outside of the human body, is comparatively easily destroyed by disinfectants in general and by variations in heat and moisture; once, however, it becomes established in the genital tract or in other locations favorable for its growth, it is most difficult to eradicate, and exhibits a clinical chronicity and a tenacity of life most at variance with its bacteriologic properties as manifested in culture-media. These peculiarities are due not to the fact that the gonococcus is so much more tenacious of life in man, but that the localities attacked are so constructed anatomically as to preclude the germicides reaching the infecting organisms. It is well established that gonococci, when first deposited upon a mucous membrane, can be readily killed or washed away, provided such treatment is employed before the microorganism has penetrated below the surface epithelium. The almost marvelous results obtained from the prophylactic treatment of gonorrhea as carried out aboard many of the ships of the United States navy, and the efficiency of the Credé prophylactic treatment of ophthalmia neonatorum, bear out this assertion. When, however, a few hours or days have been permitted to elapse and the gonococcus has penetrated the depths of the mucosa, irrigations are of much less value, for although the microorganisms on the surface are doubtless destroyed, vast numbers escape the action of the germicide. Janet<sup>1</sup> rightly believes that this constant reinfection from areas not reached by the applications is the chief cause for the resistance to treatment exhibited by gonorrhea in both men and women.

Experimental research has amply demonstrated that although

<sup>1</sup> Janet, J.: *Jour. d'Urol.*, Paris, November, 1912, vol. ii, No. 5.

certain germicides penetrate the tissues to some depth, the presence of organic matter or of various other constituents that are always present in the mucosa tends to effect a chemical change in the germicide and thus greatly or entirely nullify their effects. It is this change and the fact that gonococci are prone to inhabit the depths of the mucous glands, where they cannot be reached by the chemical agent, that account for the resistance of gonorrhea to local treatment. All clinicians know that strong caustics, by their irritant and destructive action, generally favor, rather than retard, the course of a gonorrhea. Hence the three requirements that a gonococcid to be employed in the local treatment of this disease should possess are, therefore, a destructive action on the gonococcus and on other microorganisms, such as the staphylococcus, that may be present in mixed infections; ability to penetrate the tissue without losing its germicidal properties, and a non-irritant action. No germicide as yet known entirely fulfils these requirements. The vast number of drugs in various strengths and combinations that have been employed in the treatment of gonorrhea bear evidence that the ideal gonococcid has not yet been discovered.

Marshall and Neave<sup>1</sup> have shown conclusively, by careful laboratory investigations, that the amount of silver that a compound may contain is no criterion of its bactericidal power. This fact has also been amply proved clinically, and is of importance when considering the employment of the various silver preparations now on the market.

Many methods have been employed for testing the germicidal properties of different preparations. As early as 1881 Robert Koch<sup>2</sup> undertook this difficult task. What is known as the Koch thread method consisted in saturating a silk thread in an emulsion of the microorganism, allowing these threads to dry, and subjecting them to the action of various chemical agents. The disadvantages of this method are that the organisms are dried, which in itself tends to destroy the gonococcus, and that the disinfectants are carried over with or in the thread to the culture-medium. In 1897 Krönig and Paul<sup>3</sup> suggested the "garnet" method. This consisted in anointing the surface of a number of garnets of equal size with an emulsion of the microorganisms, drying and subsequently exposing them to the action of disinfectants, and then testing them in a culture-medium for the presence of the original microorganism. A source of error in this method lies in

<sup>1</sup> Marshall, C. R., and Neave, E. F. M.: *Brit. Med. Jour.*, August 18, 1906, p. 359.

<sup>2</sup> Koch, R.: *Mittheil. a. d. kaiserl. Gesundheitsamte*, 1881, vol. i.

<sup>3</sup> Krönig and Paul: *Zeit. f. Hygiene*, 1897, vol. xxv, p. 1.

the fact that in the washing of the garnets the organisms as well as the disinfectant are likely to be washed away. Gruber,<sup>1</sup> Seligmann,<sup>2</sup> Schumburg,<sup>3</sup> and Proskauer<sup>4</sup> have all warned against accepting results formulated upon methods in which this possibility is not excluded. The danger of carrying over mercuric salts is very great, and it is probably due to a lack of knowledge regarding this point that mercury bichlorid now holds its present high place in the list of antiseptics. To guard against this possibility Chick and Martin<sup>5</sup> suggest that the mercuric salts be neutralized with a sulphid solution. These authors have shown that organisms subjected to the action of mercuric salts and subsequently washed free of the disinfectant may not grow if planted directly into broth, but that they are not necessarily damaged irretrievably, and that, if treated with a sulphid solution, a certain proportion can be resuscitated. The same authorities have demonstrated that a virulent strain of any particular species is generally somewhat more difficult to kill than a non-virulent strain. In 1903 Rideal and Walker<sup>6</sup> recommended the use of the drop method, which has since been used, with occasional slight modifications, by Firth and Macfadyen,<sup>7</sup> Post and Nicoll,<sup>8</sup> Chick and Martin,<sup>9</sup> Clark and Wylie,<sup>10</sup> Derby,<sup>11</sup> and many others. Post and Nicoll<sup>12</sup> employed the drop method as follows: One-half a cubic centimeter of the solution to be tested was placed in a small sterile test-tube. Into this was placed one platinum loopful of an emulsion (in culture broth) of a twenty-four-hour culture, in blood-agar slant, of the organism used. After one minute, ten minutes, thirty minutes, and twenty hours a loopful of the contaminated test solution was thoroughly mixed in a tube of blood-agar and plated in ordinary sterile Petri dishes. These were then incubated at 37° C., and observed after twenty-four, forty-eight, and seventy-two hours. In the case of large numbers of colonies the figures given in Post and Nicoll's tables are approximate, and if

<sup>1</sup> Gruber: *Cent. f. Bakt.*, 1891, 1. Abt., vol. xi, 1892, p. 115.

<sup>2</sup> Seligmann: *Ber. v. d. XIV. Internat. Kong. f. Hyg. u. Dem.*, Berlin, 1907, vol. ii, p. 373.

<sup>3</sup> Schumburg: *Deut. med. Woch.*, Berlin, February, 1912, vol. xxxviii, No. 9.

<sup>4</sup> Proskauer: *Ber. v. d. XIV. Internat. Kong. f. Hyg. u. Dem.*, Berlin, 1907, vol. ii, p. 973.

<sup>5</sup> Chick, H., and Martin, C. J.: *Jour. of Hygiene*, 1908, vol. viii, p. 668.

<sup>6</sup> Rideal, S., and Walker, J. I. A.: *Jour. Roy. San. Inst.*, London, 1903, vol. xxiv, p. 424.

<sup>7</sup> Firth and Macfadyen: *Jour. Roy. San. Inst.*, 1906, vol. xxvii, p. 17.

<sup>8</sup> Post, W. E., and Nicoll, H. K.: *Jour. Amer. Med. Assoc.*, November 5, 1910, p. 1635.

<sup>9</sup> Chick, H., and Martin, C. J.: *Jour. of Hygiene*, 1908, vol. viii, p. 654.

<sup>10</sup> Clark, J. B., and Wylie, L. A.: *Jour. Amer. Med. Assoc.*, July 29, 1911.

<sup>11</sup> Derby, G. S.: *Trans. Amer. Ophthal. Soc.*, 1906, vol. xi, part i, p. 21.

<sup>12</sup> Post, W. E., and Nicoll, H. K.: *Jour. Amer. Med. Assoc.*, November 5, 1910, p. 1635.



the number of the colonies was too great to permit of an approximate estimation, the sign of infinity ( $\infty$ ) was used. The organisms tested by Post and Nicoll were the gonococcus, streptococcus, pneumococcus, and typhoid bacillus. The results relating to the gonococcus obtained by these authors are shown by the following tables. The strain of gonococci utilized was isolated from a urethral discharge:

### SOLUTIONS OF THE SILVER SALTS

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 HRS.
Silver nitrate, 1 per cent. ....	0	0	0	0
" " 1:1000 .....	0	0	0	0
" " 1:5000 .....	0	0	0	0
" " 1:10,000 .....	100	0	0	0
Argyrol, 50 per cent. ....	3000	3000	2000	0
" " 10 per cent. ....	2000	2000	0	0
Protargol, 10 per cent. ....	200	0	0	0

The superiority of silver nitrate over both argyrol and protargol is manifest.

### MERCURY SOLUTIONS

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 HRS.
Bichlorid 1:500 .....	3000	20	1	0
(From Bernay's tablets)				
Bichlorid, 1:2000 .....	4000	3000	200	0
" " 1:10,000 .....	4000	500	25	0

R.				
Mercury biniodid .....	1	0	0	0
Potassium iodid. ....	1			
Sodium bicarbonate. ....	20			
Water. ....	1000			
(P. D. & Co. germicidal discs.)				

R.				
Mercury biniodid. ....	1	0	0	0
Potassium iodid. ....	1			
Sodium bicarbonate. ....	20			
Water. ....	2000			

R.				
Mercury biniodid .....	1	$\infty$	$\infty$	0
Potassium iodid. ....	1			
Sodium bicarbonate. ....	20			
Water. ....	5000			

These tests show that the action of mercury is slow, but effective, even in high dilutions, and demonstrate the futility of the ordinary mercuric salts as generally employed in antisepsis.

## SOLUTION OF THE PHENOLS

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 Hrs.
Creolin, 100 per cent.	0	0	0	0
" 1 per cent.	25	0	0	0
Creolin, 75 per cent. }	0	0	0	0
Glycerin, 25 per cent.				
Kreso, 100 per cent.	0	0	0	0
" 5 per cent.	0	0	0	0
" 1 per cent.	0	0	0	0
" 1:1000 . . . . .	5000	4000	2000	300
Kreso, 50 per cent. }	0	0	0	0
Glycerin, 50 per cent.				
Chinosol, 25 per cent.	2000	0	0	0
" 0.4 per cent.	6000	6000	4000	3000
" 1:10,000 . . . . .	5000	5000	3000	3000
Chinosol, 6 per cent. }	∞	500	60	0
Glycerin, 13 per cent.				
Lysol, 100 per cent.	0	0	0	0
" 1.5 per cent.	0	0	0	0
" 1:1000 . . . . .	500	1000	1000	50
Trikresol, 1 per cent.	0	0	0	10
" 0.3 per cent.	2000	2000	1000	50
Phenol, 5 per cent.	0	0	0	0
" 1 per cent.	4000	500	0	0
" 1:1000 . . . . .	6000	6000	4000	3000
Phenol, 50 per cent.	0	0	0	0
Glycerin, 50 per cent.	0	0	0	0
R. Phenol . . . . .	1 dr.	0	0	0
Zinc sulphate . . . . .	2 dr.			
Glycerin . . . . .	2 oz.			
Water . . . . .	8 oz.			

In this connection it is worth mentioning that kreso may be bought for about eighty cents a gallon, whereas the same amount of lysol costs between three and four dollars. The former is not, however, so refined nor so easily miscible with water as the latter, but it is more effective.

## SOLUTIONS OF IODIN

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 Hrs.
R. Iodin . . . . .	1	0	0	0
Potassium iodid . . . . .	1			
Water . . . . .	100			
(Senn's solution)				
Iodin . . . . .	1	0	0	0
Potassium iodid . . . . .	1			
Water . . . . .	400			
Tincture iodin . . . . .	0	0	0	0

These solutions killed all the organisms of the four varieties tested.

## SOLUTIONS OF LIQUOR FORMALDEHYDI

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 Hrs.
Liquor formaldehydi (U. S. P.).....	0	0	0	0
Liquor formaldehydi, 1 per cent.....	4000	2000	1000	0
“ “ 1: 1000 .....	6000	6000	6000	0
“ “ 1: 10,000 .....	4000	4000	5000	2000
“ “ 2 per cent. } .....	10000	10000	4000	0
Glycerin, 9S per cent. }				

## SOLUTIONS OF ALCOHOL

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 Hrs.
Alcohol, 1 per cent.....	300	300	300	2000
“ 5 per cent.....	500	300	10	20
“ 10 per cent.....	200	4	0	0
“ 20 per cent.....	300	0	0	0
“ 30 per cent.....	0	0	0	0
“ 50 per cent.....	0	0	0	0
“ 70 per cent.....	0	0	0	0

Alcohol seemed to kill gonococci more readily than it did the other microorganisms that were tested.

## OTHER SOLUTIONS

*Number of Colonies in One Loopful of Test Gonococcal Solution After:*

SOLUTION	1 MIN.	10 MIN.	30 MIN.	20 Hrs.
Tincture green soap.....	0	0	0	0
Chloroform.....	0	0	0	0
Ether.....	0	0	0	0
Hydrogen dioxide.....	1000	0	0	0
Thiersch's solution:				
Salicylic acid..... 2 dr. }	0	0	0	0
Boric acid..... 12 dr. }				
Water..... 1 gal. }				
Potassium permanganate, 1: 1000.....	3000	200	0	0
“ “ 1: 4000.....	3000	20	0	0
Cupric sulphate, 1 per cent.....	4000	3000	2000	0
“ “ 1: 100.....	4000	4000	2000	0
Zinc sulphate, 1: 500.....	500	400	broken	broken
Boric acid, 1: 1S.....	3000	2000	2000	0
(Saturated solution)				
Potassium chlorate, 6.6 per cent.....	3000	2000	2000	0
(Saturated solution)				
Glycerin.....	6000	6000	4000	1500
Distilled water.....	4000	2000	2000	2000

Clark and Wylie<sup>1</sup> report the following results:

**Method.**—Two cubic centimeters of the various dilutions of antiseptics to be tested were added to 2 c.c. of a salt emulsion of the gonococcus. It will immediately be seen that this procedure diluted one-half the antiseptic strength of the solution. To equalize this double the strength of the antiseptic was used. Controls were made, and the average number of colonies in a plate were noted. The tubes con-

<sup>1</sup> Clark, J. B., and Wylie, L. A.: Jour. Amer. Med. Assoc., July 29, 1911.

taining the bacteria were exposed to the different germicides for a period of five minutes, fifteen minutes, and thirty minutes, respectively, when one loopful from each tube was mixed in a tube of acetic agar and poured into a Petri dish. These were incubated at 37° C. and observed at the end of twenty-four and forty-eight hours.

*Number of Colonies in One Loopful of Test Solution After:*

SOLUTION	MICROORGANISM	5 MIN.	15 MIN.	30 MIN.
Argyrol, 30 per cent. . . . .	Gonococcus	70	50	10
" 10 per cent. . . . .	"	90	70	50
" 1 per cent. . . . .	"	120	50	25
Protargol, 10 per cent. . . . .	"	30	15	25
" 5 per cent. . . . .	"	90	50	35
" 1 per cent. . . . .	"	100	35	25
Silver nitrate, 2 per cent. . . . .	"	0	0	0
" " 1 per cent. . . . .	"	10	8	0
" " 0.5 per cent. . . . .	"	15	70	6
" " 1:1000 . . . . .	"	0	0	0
" " 1:5000 . . . . .	"	0	0	0
" " 1:10,000 . . . . .	"	525	40	20
Cresol comp., 10 per cent. . . . .	"	0	0	0
" " 5 per cent. . . . .	"	0	0	0
" " 2.5 per cent. . . . .	"	0	0	0
" " 1.2 per cent. . . . .	"	550	300	0
" " 0.5 per cent. . . . .	"	600	500	100
Collargol, 2.5 per cent. . . . .	"	80	100	15
" 1.25 per cent. . . . .	"	120	100	75
Cargentos, 20 per cent. . . . .	"	18	10	0
" 5 per cent. . . . .	"	75	0	50

Derby<sup>1</sup> has pointed out that the local action of silver nitrate, protargol, Lugol's solution, and corrosive sublimate is markedly retarded by the addition of a serum, such as hydrocele fluid or bovine blood, and that it is probable that the comparative efficiency of the various antiseptics depends largely upon this fact. Because of the difficulty of cultivating the gonococcus Derby employed the *Staphylococcus aureus* in his tests. He found that silver nitrate, when brought in contact with sodium chlorid, albumins, or urine, formed a dense precipitate; that it was an effective germicide—solutions varying in strength from 0.5 to 2 per cent. killed the organism in from two to five minutes. An exposure of thirty seconds to a 0.5 per cent. solution was generally sufficient to prevent growth in twenty-four hours, but not sufficient to kill all the cocci. Protargol in 1, 2, 4, 10, and 20 per cent. solutions was tested, but proved less efficient than the silver nitrate. When 1 c.c. of serum was mixed with 1 c.c. of the silver preparation to be tested a very marked diminution of the bactericidal power of all solution resulted. Silver nitrate, 2 per cent., showed a growth of *Staphylococcus aureus* after an exposure of from thirty to forty minutes; protargol, 8 per cent., after sixty minutes; argyrol, 50 per

<sup>1</sup> Derby: Boston Med. and Surg. Jour., September 27, 1906.

cent., gave an abundant growth after three and one-half hours—the longest interval allowed to elapse. Other preparations showed similar results, being affected in about the same proportion as was silver nitrate. That a similar effect was produced on other germicides than the silver preparations was shown by the following: Lugol's solution, composed of iodine, 1 part; potassium iodide, 2 parts; and water, 100 parts, killed the *Staphylococcus aureus* in from thirty seconds to one minute. With serum there was a growth at the end of five minutes. Corrosive sublimate 1:1000 to which serum was added showed a growth after thirty minutes.

The reliability of the ordinary drop method has been assailed on the ground that no organic matter, such as is present in every case of gonorrhea, is employed. Blyth<sup>1</sup> and Kenwood and Hewlett<sup>2</sup> have described modifications in which organic matter is included. Chick and Martin<sup>3</sup> have drawn attention to the fact that the presence of 10 per cent. blood-serum reduces the efficiency of 1 per cent. phenol about 12 per cent. The effect upon emulsified disinfectants is somewhat greater, a 0.5 per cent. solution being reduced to from 0.6 to 0.06 per cent. of its original value as the concentration of the serum was increased from 5 to 30 per cent.

Although laboratory investigations such as those just described do not reproduce conditions similar to those observed by the clinician, they nevertheless represent very nearly the relative bactericidal properties of the various germicides. Wildbolz,<sup>4</sup> of Bern, has performed a series of experiments upon dogs with a view to determining the relative penetrating properties of protargol and silver nitrate. Solutions of silver nitrate varying in strength from 1:1000 to 1:100, and protargol in from 1 to 3 per cent. solutions, were introduced into the urethra and into the eye, and the reduction of the silver accomplished by exposure to a Finsen light. So far as penetrating power was concerned the silver nitrate easily took precedence, in some instances reaching the subepithelial tissue. An important series of experiments dealing with osmosis as a factor in the action of antiseptics has been carried out by Seelig and Gould.<sup>5</sup> Although the gonococcus was not employed in these experiments, they nevertheless demonstrate conclusively the relative merits of certain germicides. These investigators, realizing that a point of vital importance in dealing with the artificial destruc-

<sup>1</sup> Blyth, W.: *Analyst*, May, 1906; *Jour. Soc. Chem. Industry*, December, 1906, vol. xxv.

<sup>2</sup> Kenwood and Hewlett: *Jour. Roy. San. Inst.*, 1906, vol. xxvii, p. i.

<sup>3</sup> Chick, H., and Martin, C. J.: *Jour. of Hygiene*, 1908, vol. viii, p. 689.

<sup>4</sup> Wildbolz, H.: *Zeit. f. Urol.*, Berlin and Leipzig, 1907, vol. i, pp. 185-200.

<sup>5</sup> Seelig, M. G., and Gould, C. W.: *Surg., Gyn., and Obst.*, March, 1911, p. 262.

tion of bacteria is the fact that these organisms are not always free on the tissue or wound surfaces, but occur in the deeper layers of the part affected, and are often covered with blood or exudate; furthermore, they believe that the bacteria themselves may possess a more or less resistant exterior, which serves as a protective shield to their vital protoplasm. These investigators emphasize the fact that, to be effective, a germicide must possess penetrating powers, and their experiments are especially directed toward determining the presence of this property. With this point in view, two series of experiments were performed. In the first, celloidin test-tubes, made according to a modification of the Harris<sup>1</sup> method, were employed. These capsules were filled with broth cultures of different bacteria and immersed in various watery solutions of antiseptics, such as phenol, mercury bichlorid, crysallic acid, and lysol. At intervals varying from ten minutes to twenty-four hours a loopful of the various cultures was removed from the capsule and plated. With the exception of one watery antiseptic, the organisms were unaffected even after so long a period as twenty-four hours. This exception was iodine. When iodine was diluted to a strength of 12.5 per cent. in water and potassium iodid, the germ-content of the capsule was sterilized in twenty-five minutes. By the starch reaction it was also possible to demonstrate that the iodine had penetrated through the celloidin into the broth. After forty-five minutes enough had penetrated to color the broth a walnut brown.

Another series of experiments was made with grain alcohol of strengths varying from 99 to 50 per cent. It was found that the higher strength alcohol penetrated the capsule very rapidly; that 94 per cent. alcohol sterilized the contents of the capsules in from three to ten minutes; that the action of 70 to 80 per cent. alcohol was much slower, and required seven and one-half hours to kill the organism, whereas 50 per cent. alcohol had no apparent effect after a twenty-four-hour exposure. These results are in accord with the recently published clinical reports from the medical department of the Prussian army.<sup>2</sup> Seelig and Gould found, therefore, that 95 per cent. alcohol was much more efficient than 80 per cent., but that 99 per cent. was not perceptibly more effectual than 95 per cent. Experiments were carried out in a similar manner with alcohol in which various germicidal drugs, such as mercury bichlorid, phenol, Harrington's solution, and iodine, had been dissolved. They found that, with the exception of iodine, unadulterated alcohol acted as rapidly and efficiently as did the alcoholic solutions of germicides.

<sup>1</sup> Harris, N.: Johns Hopkins Hospital Bull., May, 1902, p. 112.

<sup>2</sup> Kutscher, Otto, Theole, and others: Veröffent. a. d. Gebiet. d. Militärsanitätswesen, herausgeb. v. d. med. Abth. d. K. P.-Kriegsministerium, H. 44, 1909.

Furthermore, it was discovered that, by the dilution of the alcohol ordinarily necessary, its action was greatly lessened. The iodins, however, apparently augmented the germicidal properties of the alcohol. Seelig and Gould next employed an animal membrane: A small receptacle was filled with the germicidal solution to be tested, and a flap of skin, still alive and attached to the animal, was placed over the cup in such a way as to make a pouch that rested in the fluid. The same procedure was also carried out with living mesentery and omentum. Into the pouch, which was immersed on one side in the fluid to be tested, was placed a measured quantity of a broth culture of bacteria. The animal experiments, with but few exceptions, tallied with the results previously secured with the celloidin capsules. Alcohol penetrated and was effectual in direct proportion to its percentage strength. Tincture of iodine penetrated and killed bacteria even more rapidly than did strong alcohol. Watery solution of bichlorid 1:5000 was ineffectual with all membranes, although a 1:1000 solution destroyed the germ contents in forty-five minutes. Seelig and Gould's<sup>1</sup> conclusions are in direct opposition to those secured by Harrington and Walker,<sup>2</sup> who state that although absolute alcohol, or alcohol containing more than 70 per cent. by volume, is practically devoid of bactericidal power, 60 to 70 per cent. alcohol is a most valuable disinfectant, killing resistant pathogenic bacteria both in dry and in moist conditions in from three to five minutes.

AGENT	BIRTHS	PERCENTAGE OF OPHTHALMIA
Silver nitrate, 2 per cent. ....	76,452	0.7030
Silver nitrate, weaker than 2 per cent. ....	36,132	0.4230
Silver nitrate ointment, 2 per cent. ....	703	0.1420
Silver acetate, 1 per cent. ....	6,144	0.1900
Silver citrate. ....	43	4.6500
Argentamin, 0.5 per cent. ....	115	2.6000
Protargol. ....	7,383	0.0270
Argyrol. ....	6,984	0.2500
Sophol. ....	1,050	0.0950
Sophol <sup>3</sup> . ....	1,595	0.1890
Corrosive sublimate. ....	15,945	0.4069
Phenol. ....	2,148	5.4200
Boric acid. ....	701	4.5100
Iodin trichlorid. ....	761	1.2000
Salicylic acid. ....	2,130	1.0300
Potassium permanganate, 1: 1000. ....	1,316	0.5300
Iodoform. ....	1,894	3.1600
Formalin, 1 per cent. ....	120	3.3000
Zinc sulphocarbonate, 0.5 per cent. ....	500	0.2000
Lemon-juice. ....	5,008	1.2700
Citric acid. ....	15,000	1.1000
Aniodol. ....	1,844	0.6450
Alcohol, 50 and 70 per cent. ....	720	1.3600
Hermophenol. ....	250	0.4000

<sup>1</sup> Seelig, M. G., and Gould, C. W.: Surg., Gyn., and Obst., March, 1911, p. 252.

<sup>2</sup> Harrington, C., and Walker, H.: Boston Med. and Surg. Jour., 1903, vol. cxlviii, p. 548.

<sup>3</sup> Hannes: Zent. f. Gyn., 1911, No. 50.



A further exposition of the relative merits of some of the gonococidal drugs is to be found in the preceding table, showing the number of births and the percentage of cases of ophthalmia recorded, together with the different chemical agents used in the prophylaxis of ophthalmia neonatorum.<sup>1</sup>

Young and Williams<sup>2</sup> state that swabbing the uterine cavity with tincture of iodine has given better results in their hands than has any other form of treatment in cases of miscarriage and abortion. These authors present the following table, showing the results obtained with iodine and with other germicides:

CLEAN CASES		
	NUMBER OF CASES	PERCENTAGE OF MORBIDITY
Tincture of iodine . . . . .	50	2.0
Formalin, 0.5 per cent. . . . .	7	14.0
Corrosive sublimate, 1:5000 . . . . .	305	8.8
Alcohol, 50 per cent. . . . .	239	4.6
Salt solution . . . . .	345	4.3
INFECTED CASES		
Tincture of iodine . . . . .	25	4.0
Formalin, 0.5 per cent. . . . .	10	20.0
Corrosive sublimate, 1:5000 . . . . .	143	19.5
Alcohol, 50 per cent. . . . .	119	18.4
Salt solution . . . . .	138	11.6

**Silver Nitrate.**—This is probably the most efficient and widely known gonococcid that we have. According to Marshall and Neave,<sup>3</sup> silver nitrate contains 63.6 per cent. silver. Numerous attempts have been made to substitute other less irritating preparations of silver, but an extensive clinical experience with them has nearly always shown silver nitrate to be the most efficient. In the strengths ordinarily employed, silver nitrate is a mild irritant, and this constitutes, perhaps, its chief drawback. Its penetrative and germicidal properties have been fully demonstrated by numerous clinical and experimental studies. In the presence of urine, albumin, or sodium chlorid it forms a dense precipitate, but it is, nevertheless, an efficient germicide. Gros<sup>4</sup> has studied the bactericidal action of silver salts in saline solution. Pitzman<sup>5</sup> gives the following table, showing the relative germicidal properties of silver nitrate and mercury bichlorid with various dilutions of serum.

	DILUTED $\frac{1}{4}$	DILUTED $\frac{1}{8}$
Silver nitrate, 1:20,000 ± . . . . .	1:80,000 ±	1:60,000 ±
Mercury bichlorid, 1:10,000 ± . . . . .	1:40,000 ±	1:80,000 ±

± indicates a turning-point—*i. e.*, slightly fewer bacteria will grow, and slightly more will be killed.

<sup>1</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 206.

<sup>2</sup> Young, E. B., and Williams, J. T.: Boston Med. and Surg. Jour., March 7, 1912, p. 364.

<sup>3</sup> Marshall and Neave: Brit. Med. Jour., August 18, 1906, p. 359.

<sup>4</sup> Gros, O.: Münch. med. Wochenschr., February 20, 1912, vol. lxi, No. 8.

<sup>5</sup> Pitzman, M.: Amer. Jour. Ophthalm., January, 1912, p. i.

**Silver Acetate.**—Excellent results have been obtained with this silver salt in the treatment of ophthalmia by Zweifel,<sup>1</sup> Leopold,<sup>2</sup> Scipiades,<sup>3</sup> and Dauber.<sup>4</sup> Silver acetate used in a 1 per cent. solution is not only an efficient gonococcid, but, according to Dauber,<sup>5</sup> is somewhat less irritating than is silver nitrate. In Dauber's series the salt was not neutralized. Zweifel<sup>6</sup> employed a 1 per cent. solution in the prophylactic treatment of ophthalmia in 5222 babies, of which number 12 developed ophthalmia. One drop of a 1.25 per cent. solution was put into each eye, and any surplus was neutralized with a weak salt solution. Leopold did not believe that neutralization was necessary.

**Argyrol.**—Argyrol, or silver vitellin, has been extensively employed in the treatment of all forms of gonorrhea. Stephenson<sup>7</sup> asserts that this preparation contains 30 per cent. of silver combined with a protein. Marshall and Neave<sup>8</sup> found that argyrol contained 20 per cent. of silver. These last-named authors state that argyrol is practically non-bactericidal. As a prophylactic measure in preventing ophthalmia neonatorum excellent results may be obtained by the use of argyrol, as has been proved by the fact that among 6984 babies treated with this preparation, only 0.25 per cent. developed the affection. In the Maternity Hospital in Philadelphia Dr. Holloway and the author have had less satisfactory results with argyrol than were formerly obtained with silver nitrate, and hence have abandoned its use as a prophylactic agent against ophthalmia neonatorum. Derby<sup>9</sup> states that a precipitate is obtained in the presence of albumin and of urine, though the opacity of the solution tends to disguise it. The germicidal power of argyrol is exceedingly weak. In a large series of observations Derby<sup>10</sup> found that a growth of *Staphylococcus aureus* was obtained after exposure to the 10 per cent., 25 per cent., and 50 per cent. solutions for one hour, one and one-half hours, and two hours. A diminution in the number of colonies commonly appeared at the end of twenty minutes. According to Derby, the age of the solution did not seem to be of importance. Stephenson,<sup>11</sup> on the other hand, emphasizes the necessity of

<sup>1</sup> Zweifel: *Cent. f. Gyn.*, December 22, 1900.

<sup>2</sup> Leopold: *Berlin. klin. Woch.*, 1903, No. 33.

<sup>3</sup> Scipiades: *Amer. Med.*, September 26, 1903; also *Cent. f. Gyn.*, April 11, 1903.

<sup>4</sup> Dauber: *Münch. med. Woch.*, February 16, 1904.

<sup>5</sup> Dauber: *Loc. cit.*

<sup>6</sup> Zweifel: *Cent. f. Gyn.*, December 22, 1900.

<sup>7</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 194.

<sup>8</sup> Marshall, C. R., and Neave, E. F. M.: *Brit. Med. Jour.*, August 18, 1906, p. 359.

<sup>9</sup> Derby, G. S.: *Trans. Amer. Ophthal. Soc.*, 1906, vol. ii, p. 24.

<sup>10</sup> Derby, G. S.: *Loc. cit.*

<sup>11</sup> Stephenson, S.: *Ophthalmia Neonatorum*, London, 1907, p. 206.

employing fresh argyrol, and directs that it be prepared with cold water and kept away from light. In the author's experience, argyrol is absolutely unirritating, and seems to owe many of its attributes to the efficiency with which it washes away discharges. It appears to penetrate deeply into the folds of the inflamed mucosa, and to disintegrate the pus, or at all events to cleanse the tissue. In ophthalmia it is of especial value, owing to the fact that, because of its unirritating qualities, it may safely be employed even by an unskilled attendant.

**Protargol.**—This product is said to contain 8.3 per cent. of silver. Derby found that the *Staphylococcus aureus* was usually killed by a 2 or 4 per cent. solution at the end of from three to five minutes, although occasionally a few colonies grew after a ten-minute exposure. Clark and Wylie<sup>2</sup> showed that a 10 per cent. solution failed to kill all gonococci even after a thirty-minute exposure, whereas Post and Nicoll<sup>3</sup> state that a 10 per cent. solution failed to kill in one minute, but was successful in the ten- and thirty-minute exposures. Protargol is less irritating than silver nitrate, although Esman<sup>4</sup> found 20 per cent. of "silver catarrh" among 277 newly born infants treated prophylactically with a 1 or 2 per cent. solution of this preparation. v. Herff<sup>5</sup> employed a 10 per cent. solution as a prophylactic for ophthalmia neonatorum in 3009 babies, only two infections resulting, and both of these occurring late. Naturally, he speaks highly of the preparation, and believes it to be as efficient as, and less irritating than, silver nitrate. On the other hand, Chrobak,<sup>6</sup> after employing a 5 per cent. solution in the eyes of 3000 babies, has returned to the use of 2 per cent. silver nitrate. Edgar<sup>6</sup> has had a similar experience.

**Corrosive Sublimate.**—Corrosive sublimate is one of the oldest, most widely known, and most over-rated of all the germicides in common use. Among 15,945<sup>7</sup> infants treated with this drug as a prophylactic for ophthalmia, 0.4069 developed conjunctivitis. Post and Nicoll<sup>8</sup> showed that the action of the mercuric salts was slow. A mercury bichlorid solution of 1:500 failed to kill gonococci after a ten-minute exposure, and a 1:1000 solution after an exposure of half an hour. In Derby's<sup>9</sup> experiments corrosive sublimate 1:1000, to which

<sup>1</sup> Clark, J. B., and Wylie, L. A.: Jour. Amer. Med. Assoc., July 29, 1911.

<sup>2</sup> Post and Nicoll: Jour. Amer. Med. Assoc., November 5, 1910, p. 1635.

<sup>3</sup> V. Esman: Arch. f. Augenheilkunde, vol. xxxviii, No. 4.

<sup>4</sup> v. Herff: Münch. med. Woch., 1906, No. 20.

<sup>5</sup> Chrobak: Cent. f. Gyn., August 20, 1904, p. 999.

<sup>6</sup> Edgar, J. C.: Med. News, September 23, 1905.

<sup>7</sup> Stephenson, S.: Ophthalmia Neonatorum, London, 1907, p. 206.

<sup>8</sup> Post and Nicoll: Jour. Amer. Med. Assoc., November 5, 1910.

<sup>9</sup> Derby, G. S.: Trans. Amer. Ophthal. Soc., 1906, vol. ii, p. 26.

serum was added, showed a growth of *Staphylococcus aureus* after a thirty-minute exposure. Krönig and Paul<sup>1</sup> state that mercuric chlorid becomes much less germicidal in the presence of the chlorids, bromids, iodids, and hydrochloric acid, and that the mercury bichlorid tablets, as generally furnished, contain substances that diminish their anti-septic powers. From the foregoing it may be seen that distilled, or at least filtered, water should be employed in making up the solution. Kelly<sup>2</sup> asserts that poisonous symptoms may occur from the use of bichlorid solutions in the form of wet dressings, douches, or irrigations, and cautions us to bear in mind that many individuals possess an idiosyncrasy for mercury. Baux and Roques<sup>3</sup> have recently reported a fatal case of mercuric poisoning caused by an intra-uterine douche. Pitzman<sup>4</sup> states that, in the presence of albuminous fluid, in order to show any action, mercury bichlorid must exist as a free excess. A similar conclusion was reached by v. Behring.<sup>5</sup> Menge<sup>6</sup> speaks highly of mercury oxycyanid, strength of 1:5000, as a surface wash in adult females during the acute or chronic stages of genital gonorrhea.

**Iodin.**—This is best employed in various dilutions of the tincture. Iodin has been recently highly exploited for its germicidal properties as a skin disinfectant. In Post and Nicoll's series of experiments iodine killed all four varieties of organisms experimented with in these tests. Seelig and Gould<sup>7</sup> have conclusively demonstrated its penetrative and germicidal properties. It is undoubtedly one of the most efficient germicides known. Its chief disadvantage, however, in the treatment of gonorrhea, lies in its irritant properties. In certain cervical lesions, and in others situated in such localities where it can be employed, it has proved highly satisfactory. It penetrates deeply, and even in weak solutions quickly kills gonococci and other microorganisms likely to be present in gonorrhea. The strength to be employed must naturally vary according to the stage of the disease present and the location of the lesion. The official tincture contains 7 per cent. of iodine; by diluting this with 95 per cent. or, better, absolute alcohol, a most efficient gonococcid may be obtained. The experiments of Seelig and Gould<sup>8</sup> show that 95 per cent. alcohol possesses far greater

<sup>1</sup> Krönig and Paul: *Die chemischen Grundlagen der Lehre von der Giftwirkung und Desinfektion*, Leipzig, 1897.

<sup>2</sup> Kelly, H. A., and Noble, C. P.: *Gynecology and Abdominal Surgery*, Philadelphia, 1907, vol. i, p. 10.

<sup>3</sup> Baux, G., and Roques, E.: *Rev. Mens. de Gyn., d'Obst., et de Pæd.*, January, 1912.

<sup>4</sup> Pitzman, M.: *Amer. Jour. Ophthalm.*, January, 1912, p. 1.

<sup>5</sup> v. Behring: *Bekämpfung der Infektions-Krankheiten*, Leipzig, 1894.

<sup>6</sup> Menge, K.: *Handb. d. Geschlechtskrankheiten*, Vienna, 1910.

<sup>7</sup> Seelig and Gould: *Surg., Gyn., and Obst.*, March, 1911, p. 262.

<sup>8</sup> Seelig and Gould: *Surg., Gyn., and Obst.*, March, 1911, p. 262.

germicidal properties than do weaker solutions; this should, therefore, rather than alcohol of weaker strength, be employed as a diluent of tincture of iodine. The sterilizing properties of iodine for skin disinfection have been thoroughly tested by Bovée,<sup>1</sup> who found that hair and skin that had been subjected to a solution consisting of 1 part of the official tincture of iodine and 1 part absolute alcohol never produced growths. This investigator applied the full-strength tincture of iodine to the cervix, vagina, and vulva in the treatment of acute gonococcal infections in both pregnant and non-pregnant women, with signal success. As a prophylactic against ophthalmia neonatorum Bovée painted the cervix, vagina, and external genitalia with iodine shortly before the os dilated in labor. Applied to the uterine cavity after a curetage for gonorrheal endometritis tincture of iodine is perhaps the best preparation, for not only does it destroy many gonococci within the tissue, but it also practically prevents, at least temporarily, the infection from extending to the tubes, and thus safeguards the operation. In the treatment of cervical gonorrhea tincture of iodine is most efficient, as it penetrates deeply into the cervical glands.

**Alcohol.**—In 95 per cent. strength or greater, alcohol has been shown to be an excellent germicide. It not only kills microorganisms, but also penetrates deeply into the tissues. As it dries quickly, it is best employed in the form of a wet dressing frequently renewed. In the local treatment of gonorrhea it is best employed in combination with iodine. Krönig,<sup>2</sup> in a series of 720 cases, used alcohol in 50 and 70 per cent. strengths as a prophylactic for ophthalmia neonatorum, with a resulting morbidity of 1.41 per cent. Of the entire number, however, 3.7 per cent. developed a medicamentous conjunctivitis. These experiments show that better results may be obtained in the prophylactic treatment of ophthalmia neonatorum by many other drugs. It is worthy of note that, according to Lhermite<sup>3</sup> and Seelig and Gould,<sup>4</sup> the osmotic action of alcohol on the skin may be augmented by a preliminary application of castor oil or other fatty substance to the parts. Harrington and Walker<sup>5</sup> found that, in their experiments alcohols in strengths of from 60 to 70 per cent. were more bactericidal than were the stronger percentages. These authors, however, employed the old thread method, and this is probably responsible for the

<sup>1</sup> Bovée: *Amer. Jour. Obst.*, July, 1911, p. 91.

<sup>2</sup> Krönig, A.: *Cent. f. Gyn.*, March 2, 1901, p. 235.

<sup>3</sup> Lhermite: *Ann. de Chem. et de Physique*, 1855, 3me Sé. xliii, p. 420.

<sup>4</sup> Seelig and Gould: *Surg., Gyn., and Obst.*, March, 1911, p. 262.

<sup>5</sup> Harrington, C., and Walker, H.: *Boston Med. and Surg. Jour.*, May 21, 1903, p. 548.

results obtained. Krönig<sup>1</sup> has demonstrated experimentally that after several applications solutions of thymol in 60 per cent. alcohol in the strength of 1 per cent. or over were efficient in disinfecting the skin. Bits of skin treated with this solution showed no bacteriologic growth.

Shumburg<sup>2</sup> and Marquis<sup>3</sup> have recently called attention to the value of alcohol as a disinfectant and germicide.

**Formalin.**—Menge, in his recent monograph on Gonorrhea, states that formalin is one of the best gonococci known, and is especially useful in chronic gonorrhea of the endometrium on account of its non-caustic properties. v. Franque<sup>4</sup> and Gerstenberg<sup>5</sup> also recommend formalin for the treatment of endometritis.

Zweifel<sup>6</sup> employed a 1 per cent. solution as a prophylactic measure against ophthalmia neonatorum in a series of 120 cases, of which number 3.3 per cent. developed ophthalmia. As a cervical application in gonorrhea formalin gives excellent results.

**Picric Acid.**—This is an excellent gonococcid, the merits of which have not been sufficiently recognized. Ehrenfield<sup>7</sup> has shown that a 12 per cent. (saturated) aqueous picric acid solution was 50 times more germicidal than a 1 per cent. phenol solution. Mitchell<sup>8</sup> states that picric acid is a strong germicide, and that no untoward results follow applications of a 1 per cent. aqueous or alcoholic solution to large areas of skin. This author bases his opinion upon clinical experience and upon a series of experiments in which the glass-rod method was employed. He recommends picric acid as a skin disinfectant. Polak<sup>9</sup> employs this drug in the treatment of cervical gonorrhea. Pyri<sup>10</sup> and Porosz<sup>11</sup> also recommend this drug in the treatment of gonorrhea.

**Collargol.**—Marshall and Neave<sup>12</sup> report that this preparation contains 86.6 per cent. of silver, and that it is not bactericidal. It is said to be a colloidal solution of metallic silver. Derby<sup>13</sup> states that it forms a somewhat opaque solution, and that no precipitate with

<sup>1</sup> Krönig: Experimentelles und Klinisches zur Desinfektion des Operationsfeldes mit Thymol-Spiritus; A. Hoffmann, from the Greifswald Surgical Clinic of Professor Fr. Krönig, Beiträge zur klin. Chir., vol. lxxvi, H. 2; also Zentralbl. f. Chir., 1911, vol. xxxviii, p. 827.

<sup>2</sup> Shumburg: Deut. med. Woch., February 29, 1912.

<sup>3</sup> Marquis, E.: Soc. de Chir. de Paris, November 22, 1911; Bull. et Mémoires, 1911, No. 35, p. 1265.

<sup>4</sup> v. Franque: Münch. med. Woch., 1903.

<sup>5</sup> Gerstenberg: Centralbl. f. Gyn., 1900.

<sup>6</sup> Zweifel: Cent. f. Gyn., December 22, 1900.

<sup>7</sup> Ehrenfield: Jour. Amer. Med. Assoc., February, 1911, vol. lvi.

<sup>8</sup> Mitchell, O. W. H.: Ann. Surg., Philadelphia, 1911, vol. liv, p. 230.

<sup>9</sup> Polak: Personal communication.

<sup>10</sup> Pyri: Gaceta Med. Catal. Rev. Espan. d. Sifi. y Dermat., 1904, No. 61.

<sup>11</sup> Porosz: Wien. med. Presse, 1902, Nos. 10 and 11.

<sup>12</sup> Marshall and Neave: Brit. Med. Jour., August 18, 1906, p. 359.

<sup>13</sup> Derby, G. S.: Trans. Amer. Ophthal. Soc., 1908, vol. xi, p. 23.



albumin or urine could be detected. This observer found its bactericidal powers to be comparatively weak, as a growth of *Staphylococcus aureus* could be obtained at the end of twenty minutes after using the 4 per cent. solution. With a 1 per cent. solution a growth was obtained at the end of one hour (drop method).

Gennerich<sup>1</sup> reports the results obtained with this preparation in the treatment of arthritis and other acute sequelae of gonorrhea.

**Phenol.**—Since the days of Lister phenol has been extensively employed as a germicide. In 1876 Schiess,<sup>2</sup> and five years later Macdonald,<sup>3</sup> employed phenol as a prophylactic against ophthalmia neonatorum. Of 2148 infants treated with phenol, 5.42 per cent. developed ophthalmia neonatorum (Stephenson<sup>4</sup>). Slack and Wade<sup>5</sup> speak highly of phenol as a germicide. Owing to its destructive and irritant properties in strong solutions and its non-penetrating action in weak solutions, as a gonococcid phenol is inferior to many other drugs.

**Ichthyol.**—This preparation has been highly recommended as an antiseptic and alterative in the treatment of gonorrhea. It is obtained from the distillation of bituminous mineral rich in fossil fish. The commercial product represents various salts of sulphichthyolic acid, the latter being obtained by treating the oily distillate with concentrated sulphuric acid (Stevens<sup>6</sup>). Ichthyol is, as a rule, unirritating, but occasionally, either as the result of impurities or peculiar sensibility of the patient, the preparation may produce marked inflammation. Dawbarn<sup>7</sup> suggests that this may be caused by ichthyol manufactured from originally poisonous fish.

**Lysol** is said to contain about 50 per cent. of cresol, and mixes with water to form a clear or opaque, saponaceous, frothy fluid. It is a moderately powerful germicide, and has been extensively employed in various strengths for vaginal irrigations. Post and Nicoll<sup>8</sup> found that 1.5 per cent. solution killed all microorganisms, but that a 1:1000 solution was ineffective.

**Boric Acid.**—In 701 cases in which boric acid was employed as a prophylactic against ophthalmia neonatorum, 4.51 per cent. developed ophthalmia neonatorum (Stephenson<sup>9</sup>). In solutions of 2 to 6 per cent. its germicidal powers are comparatively weak. In Post and

<sup>1</sup> Gennerich: Münch. med. Woch., April 9, 1912.

<sup>2</sup> Schiess: Corr.-Blatt f. Schweiz. Aerzte, 1876, p. 674.

<sup>3</sup> Macdonald, A.: Edinburgh Med. Jour., 1881, p. 111.

<sup>4</sup> Stephenson, S.: Ophthal. Neonat., London, 1907, p. 206.

<sup>5</sup> Slack, F. H., and Wade, E. M.: Amer. Jour. Pub. Hyg., 1910, vol. xx, No. 6, p. 838.

<sup>6</sup> Stevens, A. A.: A Manual of Therapeutics, 1896, p. 171.

<sup>7</sup> Dawbarn, R. H. M.: New York Med. Jour., September 3, 1910, p. 406.

<sup>8</sup> Post and Nicoll: Jour. Amer. Med. Assoc., November 5, 1910, p. 1635.

<sup>9</sup> Stephenson, S.: Ophthal. Neonat., London, 1907, p. 206.



Nicoll's<sup>1</sup> experiments a saturated solution failed to kill bacteria in thirty minutes. Owing to its unirritating properties, boric acid has been employed extensively for vaginal irrigations, either alone or in combination with alum, phenol, or common salt.

Further references to this subject may be found in the works of Müller,<sup>2</sup> Puckner,<sup>3</sup> Cragin,<sup>4</sup> Cooper,<sup>5</sup> Lohnstein,<sup>6</sup> Anderson and McClintic,<sup>7</sup> Kendal and Martin,<sup>8</sup> and Phelps.<sup>9</sup>

#### SERUM AND VACCINE THERAPY FOR GONORRHEA

Many divergent views are held as to the benefits to be derived from the treatment of gonorrhea by either sera or vaccines. Undoubtedly, many factors contribute to the difference of opinion upon this subject. The advantages to be derived from the employment of either the serum or the vaccine treatment vary largely with the lesion, the stage of the disease, the type of infection present (pure gonococcal or mixed infection), its severity, and the quality and quantity of the serum or vaccine employed. As a general rule, to which certain exceptions exist, it may be stated that systemic infections or local manifestations of systemic infections are more amenable to this form of treatment than is simple uncomplicated gonorrhea of the genital tract. An exception to this, however, is gonorrheal vulvovaginitis in children, this form of treatment having been, usually, highly successful in these cases. Chronic gonorrheal conditions are generally more markedly benefited by the administration of serum or vaccine than are acute lesions. In gonorrheal arthritis the results obtained from this form of treatment have been most excellent. On the other hand, little can be hoped for in the treatment of pelvic inflammatory disease. The warning of Wright<sup>10</sup> has been amply justified. This writer draws especial attention to the paralytic action brought to bear on the leukocytes by the tryptic ferments liberated from disintegrating pus-cells in abscess-cavities, and to the futility of attempting to cure them by vaccine therapy unless they are emptied frequently and flooded with opsonic fluid fresh from the circulatory blood.

**Indication for the Use of Antigonococcic Serum and for Vaccines.**  
—When the condition of the patient is such that she cannot

<sup>1</sup> Post and Nicoll: Jour. Amer. Med. Assoc., November 5, 1910, p. 1635.

<sup>2</sup> Müller: Berlin. thierärztl. Woch., 1902, p. 267.

<sup>3</sup> Puckner, W. A.: Jour. Amer. Med. Assoc., 1906, p. 1256.

<sup>4</sup> Cragin, E. B.: Jour. Surg., Gyn., and Obst., 1907.

<sup>5</sup> Cooper, J. B.: The Ophthalmoscope, 1907, p. 16.

<sup>6</sup> Lohnstein: Monatsb. f. Urologie, 1904

<sup>7</sup> Anderson, J. F., and McClintic, T. B.: Jour. Infec. Dis., January 3, 1911.

<sup>8</sup> Kendal, A. I., and Martin, E.: Jour. Infec. Dis., March 6, 1911.

<sup>9</sup> Phelps, E. B.: Jour. Infec. Dis., January 3, 1911.

<sup>10</sup> Wright: Quoted by Ballenger: Trans. Amer. Med. Assoc., May 30, 1908, p. 1784.

produce her own antibodies, these may be partially supplied by the injection of serum. Serum is perhaps more dangerous than vaccine. Williams, Cragin, and Newell<sup>1</sup> state that in gonorrheal arthritis and urethritis vaccine therapy is a valuable adjunct to other forms of treatment, and may occasionally alone lead to a cure. It appears to be useless in acute infections, whereas in the treatment of vulvovaginitis of children it is perhaps more efficient than any other form, but even in these cases a cure does not always result. In certain cases of endometritis and as a postoperative remedy for pelvic inflammation it may be of value. Stellwagen<sup>2</sup> believes that antigonococcic serum is indicated in all complicated cases of gonorrhea, and he has never seen any ill effects follow the treatment except a slight eruption that soon disappeared. Butler and Long<sup>3</sup> report the results obtained in a series of girls suffering from vulvovaginitis treated with vaccine. The patients varied in age from one and one-half to two years. A control series of cases was treated locally without the use of vaccines. In the series treated with vaccines the discharge diminished and the gonococcus disappeared more quickly than in the series treated by local measures alone. Butler and Long employed the Wright technic, and were guided in their treatment by the opsonic index. In certain eye lesions vaccines and sera have given excellent results. Stoner<sup>4</sup> has collected the following statistics relative to the benefits to be derived from vaccine therapy in various conditions:

## GONOCOCCIC SEPTICEMIA

AUTHORS	CASES	CURED	IMPROVED	REMARKS
Eyre (Lancet, 1909, vol. ii, p. 76)	1	0	1	
Dieulafoy (Presse Médicale, 1909, p. 353)	2	2	0	
Irons (Arch. Internat. Med., 1908, vol. v, p. 276)	3	0	0	3 not benefited.
Miller (Glasgow Med. Jour., 1908, p. 356)	1	1	0	
	7	3	1	

Treatment was not restricted to vaccines.

Illman and Duncan<sup>5</sup> report the history of a case of gonorrheal proctitis successfully treated with gonococcic vaccine. Ballenger<sup>6</sup> publishes the histories of three cases of gonorrheal urethrocystitis

<sup>1</sup> Williams, J. W., Cragin, E. B., and Newell, F. S.: Surg., Gyn., and Obst., 1910, vol. xi, 2, p. 12.

<sup>2</sup> Stellwagen, T. C.: Therap. Gaz., 1910, vol. iii, Ser. 26, No. 34, p. 249.

<sup>3</sup> Butler, W. J., and Long, J. P.: Ill. Med. Jour., 1908, vol. xiii, p. 538.

<sup>4</sup> Stoner, H. W.: Amer. Jour. Med. Sci., 1911, new series, vol. cxli, pp. 186-213.

<sup>5</sup> Illman and Duncan: New York Med. Jour., 1908, p. 1228.

<sup>6</sup> Ballenger: Jour. Amer. Med. Assoc., 1908, vol. i, p. 1784.

treated with vaccine with much benefit. Tuttle<sup>1</sup> describes a case of gonorrheal salpingitis cured by vaccines. Roark<sup>2</sup> records the history of a case of gonorrheal keratosis that was apparently greatly benefited by the use of this form of treatment.

## VAGINITIS IN CHILDREN

AUTHORS	CASES	CURED	IMPROVED	REMARKS
Ohlmacher (Jour. Amer. Med. Assoc., 1908, vol. xlviii, p. 571)	2	2	0	
Butler (The Practitioner, 1905, vol. lxxvii, p. 589)	12	10	2	
Hamilton (Jour. Infect. Dis., 1908, vol. v, 158)	67	0	64	1 not benefited.
Churchill (Jour. Amer. Med. Assoc., 1908, vol. li, p. 1298)	17	10	7	
Butler (Jour. Amer. Med. Assoc., 1908, vol. li, p. 1301)	25	0	25	
Ladd and Russ (Cleveland Med. Jour., 1909, p. 135)	3	2	1	
Thomas (Jour. Amer. Med. Assoc., 1910, vol. liv, p. 362)	1	0	1	
Hamilton (Jour. Amer. Med. Assoc., 1910, vol. liv, p. 1196)	84	76	0	5 not cured, 3 lost.
	211	100	100	6 not benefited.

Hamilton<sup>3</sup> gives the following table, showing the results obtained by vaccine treatment of gonorrheal vaginitis compared with irrigation methods.

TREATMENT	CASES	CURED	NOT CURED	LOST	PER CENT CURED
Irrigation	260	158	53	49	60
Vaccine	84	76	5	3	90

Average length of time under active treatment by the irrigation method, 10.1 months.

Average length of time under active treatment by the vaccine method, 1.7 months.

Morrow and Bridgman<sup>4</sup> present the following table, showing the results obtained in the treatment of 300 cases of gonorrhea in girls:

TREATMENT USED	NUMBER OF CASES TREATED	TIME REQUIRED FOR GERMS TO DISAPPEAR		
		Least (months)	Greatest (months)	Average (months)
Four per cent. silver nitrate	120	2	24	11
Vaccine alone	17	1	5	4
Vaccine and ichthyol	101	1	8	4
Vaccine and 25 per cent. silver nitrate	30	17-30	4	2
25 per cent. silver nitrate	32	10-30	4	2

<sup>1</sup> Tuttle: Med. Rec., 1910, p. 2052.

<sup>2</sup> Roark, B. H.: Jour. Amer. Med. Assoc., November 23, 1912, p. 2039.

<sup>3</sup> Hamilton, B. W.: Jour. Amer. Med. Assoc., April 9, 1910, p. 1196.

<sup>4</sup> Morrow, L., and Bridgman, O.: Jour. Amer. Med. Assoc., May 25, 1912, p. 1564.

These authors state that in those cases in which vigorous local treatment alone was employed the results have been quite as satisfactory as when the treatment has been combined with vaccine, and that in the case of little girls, apart from the question of expense, the vaccine treatment alone is not entirely satisfactory because of the tendency of the disease to recur. Weinstein<sup>1</sup> reports the result ob-

## GONORRHEAL ARTHRITIS

AUTHORS	CASES	CURED	IMPROVED	REMARKS
Ohlmacher (Jour. Amer. Med. Assoc., 1907, vol. xlviii, 571) . . . . .	2	1	1	
Cole and Meakins (Johns Hopkins Hospital Bull., 1907, vol. xviii, p. 223) . . .	15	10	5	
McArthurs (Surg., Gyn., and Obst., 1907, vol. v, p. 373) . . . . .	1	1	0	
Bristow (New York State Jour. Med., 1908, vol. viii, p. 121) . . . . .	1	1	0	
Irons (Jour. Infect. Dis., 1908, vol. v, p. 279) . . . . .	31	18	9	4 not benefited.
Illman (New York Med. Jour., 1908, p. 1228) . . . . .	2	2	0	
Whitemore (Philippine Jour. Science, 1908, p. 421) . . . . .	1	1	0	
Mainini (Presse Médicale, 1909, p. 40) . .	4	0	4	
Ladd and Russ (Cleveland Med. Jour., 1909, p. 135) . . . . .	11	0	11	
Maute (Comp. Soc. de Biol., 1909, p. 517) . . . . .	1	1	0	
Oastler (Amer. Jour. Obst., 1909, p. 594) . . . . .	1	1	0	
Dieulafoy (Presse Médicale, 1909, p. 353) . . . . .	18	7	8	3 not benefited.
White and Eyre (Lancet, London, 1909, vol. i, p. 1586) . . . . .	4	1	0	
Eyre and Stewart (Lancet, London, 1909, vol. ii, p. 76) . . . . .	26	18	8	
Thomas (Jour. Amer. Med. Assoc., 1910, vol. liv, p. 362) . . . . .	4	2	2	
Hartwell (Ann. Surg., 1909, vol. ii, p. 939) . . . . .	51	0	42	9 not benefited.
Macdonald (Jour. Amer. Med. Assoc., 1910, vol. liv, p. 966) . . . . .	14	9	1	4 not benefited.
Jack (Glasgow Med. Jour., 1910, p. 255) .	4	4	0	
Miller (Glasgow Med. Jour., 1910, p. 262) . . . . .	1	1	0	
Schultz (J. H. Schultz, Deutsch. med. Woch., December 14, 1911) . . . . .	16	0	11	5 not benefited.
	211	84	102	25 not benefited.

tained in the treatment of 15 little girls treated with vaccines. A cure was effected in every case in which gonococci were demonstrable in the vaginal discharge. The author concludes that the treatment was entirely satisfactory.

Schindler<sup>2</sup> recommends vaccines for the treatment of arthritis, but

<sup>1</sup> Weinstein: Münch. med. Woch., 1910, No. 14, p. 762.

<sup>2</sup> Schindler: Berlin. klin. Woch., vol. xlvii, No. 31.

declares that caution is necessary, as the infection may be mixed with bacteria over which gonococcal vaccines will exert no influence, or that the tissues may already be so seriously destroyed by the disease as to secure but little benefit to the patient.

## GONORRHEAL CONJUNCTIVITIS

AUTHORS	CASES	CURED	IMPROVED	REMARKS
Ohlmacher (Jour. Amer. Med. Assoc., 1907, vol. xlviii, p. 571).....	3	2	1	..
Eyre and Stewart (Lancet, London, 1909, vol. ii, p. 76).....	1	0	0	1 not benefited.
Miller (Glasgow Med. Jour., 1910, p. 262).....	2	2	0	..
Total.....	6	4	1	1 not benefited.

## GONORRHEAL IRITIS

AUTHORS	CASES	CURED	IMPROVED	REMARKS
Eyre and Stewart (Lancet, London, 1909, vol. ii, p. 76).....	4	3	1	..
Miller (Glasgow Med. Jour., 1910, p. 262).....	1	1	0	..
Shumway (Ann. Ophthalmology, 1910, vol. xix, p. 233).....	1	1	0	..
Total.....	6	5	1	..

Bryan<sup>1</sup> states that serum has proved of value in cases of gonorrheal iritis, but that it is useless in conjunctivitis. Schmidt<sup>2</sup> believes that the cure of cervical gonorrhea is in many cases doubtful. This author treated 24 cases of gonorrheal cervicitis, employing two kinds of vaccine—that of Bruck and that of Reiter. Twelve of the cases were entirely cured. Microscopic examination of the discharge from these cases was made four to ten weeks after treatment. The discharge examined was secured in each case shortly after the menstrual period. Eight of the cases were treated with arthigon of Bruck, and 16 with Reiter's vaccine. Schmidt's conclusions are that in cervicitis vaccines sometimes effect a cure; that the best results are obtained in vulvo-vaginitis; in arthritis only relief of pain is secured. No good results follow the use of vaccines in cases of urethritis. No local or general ill effects were observed from the use of the vaccines. Heinsius<sup>3</sup> reports treating 10 cases of gonorrhea in women with autogenous

<sup>1</sup> Bryan, C. W. G.: Brit. Med. Jour., March 30, 1912.

<sup>2</sup> Schmidt, A.: Münch. med. Woch., October 10, 1911.

<sup>3</sup> Heinsius, F.: Monats. f. Geb. u. Gyn., April, 1911, p. 426.

vaccine. All were improved. Friedländer<sup>1</sup> and Farbach<sup>2</sup> report similar results. Slingenberg<sup>3</sup> reports the results obtained in a series of girls and women treated with polyvalent vaccine in Treub's clinic. The children suffered from vulvovaginitis, and the women from various adnexal lesions. All were out-patients, so that temperature control was not always possible. In some of the patients the treatment was very successful. In some reaction was intense even when minute doses were employed, so that Slingenberg urges caution in its use. In others the reaction was mild. This author asserts that a diagnostic course of inoculations with progressive dosage which fail to induce any reaction can be accepted as excluding gonorrhea. Van de Velde<sup>4</sup> declares that an unusually low opsonic index generally indicates gonorrhea, and a diagnostic vaccination will decide the matter in doubtful cases, although caution should be observed. Adnexal lesions swell and grow tender during the negative phase after the inoculation. Recent or active inflammation of the tubes or ovaries contraindicates the diagnostic use of vaccines, as exacerbations may result under these conditions. Van de Velde suggests beginning all cases with a small test vaccination, and controlling the findings with the opsonic index. By this means valuable information may be derived without danger to the patient. Recio<sup>5</sup> reports favorably on the diagnostic value of vaccines in cases of gonorrhea.

**Antigonococcic Serum.**—In 1906 Torrey<sup>6</sup> briefly described an antigonococcic serum that had been found efficacious in the treatment of gonorrheal arthritis, and in a later communication Roberts and Torrey<sup>7</sup> confirmed the previous work of the latter author.

*Preparation of Antigonococcic Serum.*—The only serum with which the author has had any experience is that manufactured by Parke, Davis and Co. This is prepared from the blood of healthy rams that have been treated with gradually increasing doses of dead and live cultures of virulent strains of gonococci. Careful attention is given to the treatment of these animals, and great care exercised in the collection of the blood and in the separation of the serum. The process of obtaining the serum from the blood is essentially the same as that employed in the production of antidiphtheric and other sera. Four-

<sup>1</sup> Friedländer: Berlin. klin. Woch., 1910, No. 36.

<sup>2</sup> Farbach: Kentucky Med. Jour., September 15, 1912.

<sup>3</sup> Slingenberg, B.: Arch. f. Gyn., Berlin, 1912, vol. xevi, No. 2.

<sup>4</sup> Van de Velde, T. H.: Monats. f. Geb. u. Gyn., Berlin, April, 1912, vol. xxxv, No. 4.

<sup>5</sup> Recio, A.: Revista de Medicina y Cirugia, Havana, April 25, 1912.

<sup>6</sup> Torrey, J. C.: Jour. Amer. Med. Assoc., January 27, 1906, p. 261.

<sup>7</sup> Roberts, J., and Torrey, J. C.: Jour. Amer. Med. Assoc., September 14, 1907.

tenths of 1 per cent. of trikresol is added as a preservative. The serum is stored in hermetically sealed glass bulbs or syringe containers. These hold 2 c.c. each.

*Dosage.*—This is usually 2 c.c. of serum given as a single dose, and it may be repeated in one, two, three, or four days. Roberts and Torrey<sup>1</sup> recommend that, as a rule, the injection be administered every other day. In this regard, however, they state that the physician must be guided by the general condition of the patient, the degree of reaction to the serum, and the variety of serum employed. In some instances it is necessary to allow an interval of from four to six days to elapse between the injections. Schmidt<sup>2</sup> recommends that 2 c.c. be given for two, four, or five successive days, and he has at times increased the dose to 4 c.c., with intervals of one to five days, giving as much as 6 or 8 c.c. at intervals of five days. He has never seen serious results follow. The frequency of the dose must be partially governed by the individual case.

*Technic of Administration.*—The best site for making the injection is at a point where there is considerable subcutaneous tissue, such as the buttock or thigh. Strict asepsis must be maintained throughout the entire operation. The skin should be sterilized by means of soap and water, alcohol, and a 5 per cent. solution of phenol. This disinfectant is recommended, as it is claimed that the anesthetic properties of the phenol diminish the pain of the injection. The serum should be injected quite slowly. In order to make certain that the needle has not punctured a blood-vessel Schmidt<sup>3</sup> recommends that the syringe be detached from the needle after its insertion in order to see that no blood follows. The same author suggests that a small quantity of sterile normal salt solution be injected after the serum, so as to prevent any of the latter from escaping when the needle is withdrawn. The wound should be sealed with collodion. At the completion of the operation the site of the injection should be lightly massaged.

*Reaction.*—This varies considerably in different individuals. Local swelling, redness, heat, itching, burning sensations, and soreness about the point of injection may be present in varying degrees in some patients. In others, little or no reaction is observed. This reaction is not caused by the presence of an antibody on the serum, but is due to the local toxic action of the serum itself, and is partly referable to the idiosyncrasy of the individual patient. Malaise, slight eleva-

<sup>1</sup> Roberts, J., and Torrey, J. C.: *Ibid.*

<sup>2</sup> Schmidt, L. E.: *Therap. Gaz.*, September 15, 1909, p. 609.

<sup>3</sup> Schmidt, L. E.: *Therap. Gaz.*, September 15, 1909, p. 609.



tion of temperature, or anorexia may also occur. A slight increase in the discharge from the genital tract is frequently observed for a few days following the treatment.

#### VACCINES

Vaccines or bacterins are preparations of approximately known numbers of dead gonococci suspended in physiologic salt solution. Stock or autogenous vaccines may be employed, and the consensus of opinion seems to favor the use of the latter when they are obtainable. Autogenous vaccines are especially prepared from cultures of gonococci obtained from the patient, whereas stock vaccines are more easily obtainable. These are prepared from a number of strains of virulent gonococci, the microorganisms of from seven to ten strains usually being employed. The cultures are grown on ascitic agar, and are washed off with normal salt solution and shaken to separate the cocci thoroughly from one another. The suspension is then sterilized with heat at 60° C. for forty minutes. It is then diluted and standardized to represent a definite number of gonococci to the cubic centimeter. Eyre and Stewart<sup>1</sup> state that a stock vaccine, prepared from 12 different strains of gonococci, gives results only slightly inferior to those obtained by the use of an autogenous vaccine. To overcome the delay necessary in obtaining an autogenous vaccine some investigators begin the treatment with stock vaccine and substitute the autogenous vaccine as soon as the latter can be obtained. Parke, Davis and Co. prepare a stock vaccine in three strengths, so that 1 c.c. contains respectively 20,000,000, 100,000,000, and 500,000,000 bacteria per cubic centimeter. The physiologic salt solution used in this work contains 0.2 per cent. of trikresol as a preservative. It is sold in hermetically sealed containers. Vaccines prepared from recently isolated strains are more toxic than when the microorganisms have been subcultured for prolonged periods.

**Technic of Administration.**—The technic of administration is similar to that employed for the serum.

**Opsonic Index.**—Most authorities concede that the opsonic index is a valuable guide to this form of treatment, and should be employed whenever possible. On the other hand, the method of determining the opsonic index is somewhat complicated, and unless performed by one especially skilled in its use is of little or no value. For these reasons some investigators have depended upon the clinical symptoms as a guide to vaccine therapy. The judicious use of bacterins appears to be devoid of harmful consequences, and for this reason, if it is not

<sup>1</sup> Eyre, J. W. H., and Stewart, B. H.: *Lancet*, London, July 10, 1909, p. 76.

feasible to utilize the opsonic index, the clinical symptoms may be relied upon as a valuable guide in determining the size, number, and frequency of the dosage. Eyre and Stewart<sup>1</sup> state that in chronic complicated cases in which the gonococcus alone is present, and in which the opsonic index cannot be obtained as frequently as is desired, routine injections of 1,000,000 to 2,000,000 gonococci every three to five days are safe and satisfactory. There should be a lapse of from five to seven days after a dose of 5,000,000, and an interval of eight to ten days after an inoculation of 10,000,000. When the opsonic index has not previously been determined, small doses should be employed.

*Dosage.*—It is best to begin with a comparatively small dose, 5,000,000 to 20,000,000, but larger doses are usually required before a cure is effected. Doses are usually gradually increased until one is reached that produces the maximum of the positive phase with the minimum of the negative phase. This is generally about 20,000,000, although it may reach 100,000,000 or even more. A second injection should be administered when the positive phase is beginning to wane. The number of doses required generally varies from 1 to 8, 4 or 5 being about the average, with intervals between the doses of from five to ten days. As a general rule, in chronic cases it is best to begin with small doses and gradually to increase them at frequent intervals. The use of large doses is more dangerous in chronic cases than in acute attacks. A local reaction not infrequently follows the initial injection. Shropshire<sup>2</sup> states that bacterins not only sometimes cause local discomfort at the site of the injection, but may be followed by pain, swelling, fever, general uneasiness, malaise, and occasionally headaches. These manifestations are of short duration and of mild grade. In most cases the injection is followed for a few days by an increased discharge. Shropshire reports having treated 111 cases of acute gonorrhea, of which 100 were cured; 30 cases of arthritis, with 28 cures; and 5 cases of gonococcemia, all of which were cured. Thomas<sup>3</sup> states that the essential point to be carried out in immunizing, whether by vaccines or sera, is progressive increase in dosage, beginning with the minimum and steadily increasing until tolerance is established. It is also to be remembered that small doses at prolonged intervals are prone to produce anaphylaxis and hypersusceptibility. So, too, intolerance can be produced if the inoculations are not too frequent, but are too large. Bruck<sup>4</sup> holds that strong reaction and

<sup>1</sup> Eyre, J. W. H., and Stewart, B. H.: *Lancet*, London, July 10, 1909, p. 76.

<sup>2</sup> Shropshire, C. W.: *South. Med. Jour.*, May, 1911, p. 352.

<sup>3</sup> Thomas, B. G.: *Jour. Amer. Med. Assoc.*, January 22, 1910.

<sup>4</sup> Bruck: *Med. Klinik*, 1910, No. 21.

rise of temperature are necessary for active immunization. His arthigon contains 20,000,000 gonococci to 1 c.c. He injects 0.5, 1.0, 1.5 and 2 c.c. at intervals of from three to four days. Butler and Long<sup>1</sup> state that in their series the dosage varied quite markedly in different cases, and could be determined only for each individual case by the immunizing response to a given dose as indicated by the opsonic index. The minimum dose was 1,000,000, and the maximum, 50,000,000. Stoner<sup>2</sup> suggests that vaccines should be employed only after blood cultures have been made and the infecting organism identified by a skilled bacteriologist, or in local infections in which the organism has been isolated and identified, or in cases the symptoms of which are so marked that a mistake in diagnosis is beyond a possibility.

As previously stated, markedly beneficial results have undoubtedly been obtained by vaccine and serum therapy in certain classes of cases—perhaps most notably in arthritis, although excellent results have also been secured in the treatment of vulvovaginitis of children, in systemic manifestation, and in certain other conditions. Nevertheless, more experiments with serum and vaccine therapy are required before the actual value and scope of these forms of treatment can positively be determined.

<sup>1</sup> Butler, W. J., and Long, J. P.: *Ill. Med. Jour.*, 1908, vol. xiii, p. 538.

<sup>2</sup> Stoner, W. H.: *Amer. Jour. Med. Sci.*, 1911, new series, vol. cxli, p. 210.



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